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EXPERIMENTS WITH THE SCIENTIFIC TOP.

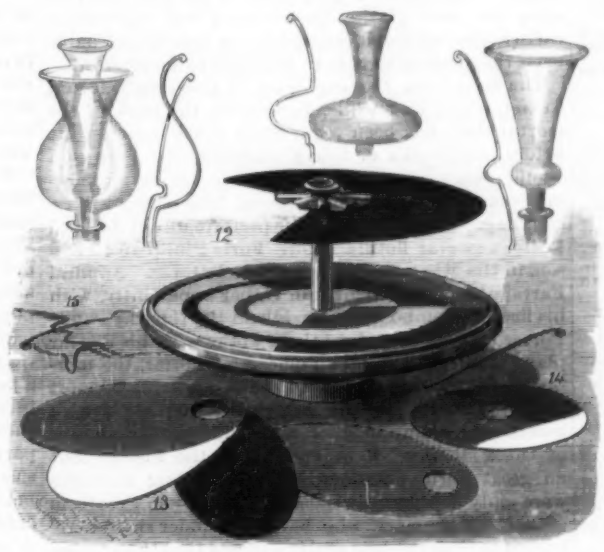
BY GEO. M. HOPKINS.

A scientific top and a few experiments adapted to it were described in the last issue of this journal. Several other experiments, possessing more or less interest, are illustrated by the annexed engravings.

The ability of the heavy top to run for a long time and maintain an equable motion renders it particularly serviceable in experiments requiring uniformity of action.

Two experiments in sound are illustrated: Fig. 1 showing the adaptation of a simple siren to the top, and Fig. 2 Savart's wheel. The siren consists of a disk of pasteboard, having four concentric rows of 3/8 inch holes, there being 12 holes in the inner row, 15 in the next, 18 in the next, and 24 in the outer row. The disk is varnished with shellac to render it waterproof. It is mounted on a chuck fitted to the tapering hole of the top spindle. When the disk is rapidly rotated by the top, and a jet of air is blown upon either row of holes through a flexible tube provided with a small glass or metallic nozzle, a musical sound will be produced by the air pulsations caused by the interruptions of the air jet by the perforated disk. The sounds produced by the different rows of holes are those of the perfect major chord. A large number of experiments with this simple siren are described in Prof. A. M. Mayer's interesting little book on sound. Savart's wheel is simply a toothed disk fitted to the chuck and adapted to be rotated by the top. When the disk is turned very slowly, with the edge of a card held against the teeth, a series of little taps are heard, which do not at all resemble a musical sound; but when the wheel is revolved rapidly by the top, the contact of the card with its periphery produces a sound that may fairly be called musical, the sound being composed of the rapidly repeated taps.

In Figure 3 is shown a disk similar to that used for the siren, but having double the number of holes in each circular row. The holes are 1/4 inch in diameter. The disk is blackened to render the effects more conspicuous, and the hole in the center of the disk is eyeleted to prevent wear. A metal disk, secured to a tapering spindle fitted into the top spindle, carries a crank pin 1/8 inch from the axis of rotation. The eyelet of the disk is placed loosely on this crank pin, and when the crank is revolved by the top the disk is gyrated; every part of its surface being made to travel in a circular path 3/8 inch in diameter, when sufficient friction is applied to it to prevent it from rotating with the top. In this case each perforation of the disk forms a circle, and the circles formed by the entire series of holes interlace, appearing like so many chain links interlocked. By allowing the disk to revolve at different speeds very complicated figures are produced, sometimes like lacework, sometimes like twisted chainwork. Occasionally one part of the figure will appear to turn in one direction while another part turns in the opposite direction. Some of these figures are shown in Figs. 4 and 5. A similar experiment, developed in a different way, is shown in Fig. 7. The black cardboard disk is provided with a central eyelet, which receives the crank pin, as in the case of the perforated disk. On each of two diametrical lines crossing each other at right angles are formed pairs of holes, in which are cemented silvered glass beads or bright spherical steel buttons. The latter were used on the disk illustrated. They are symmetrically arranged, so that the inner four may follow each other in the same path, and the outer four may follow each other in a path of their own.



THE CHAMELEON TOP.

By treating this disk after the manner of the perforated disk above described, many brilliant and surprising effects may be produced.

By holding one edge of the disk lightly between the thumb and finger, so that it will not revolve, but will be made to gyrate by the little crank, each button will describe a 3/8 inch circle, or a small oval, or an ellipse, as shown in Fig. 7. By allowing the disk to slip slowly between the thumb and finger, a series of double scrolls will be produced, as shown in Fig. 8.

By varying the speed of rotation by the application of more or less friction to the disk, a great variety of intricate and beautiful figures are produced. Examples are shown in Figs. 9, 10, and 11. The effect shown in Fig. 11 is secured by allowing the edge of the gyrating disk to strike the finger once during each gyration. The luminous curve in this case appears to have a slow retrograde motion.

In Fig. 16 is shown a cardboard disk mounted loosely on the top spindle and provided with two series of black radial bars, the inner series having 13 bars, the outer series having 12 bars. To the chuck inserted in the spindle is secured a black disk having four radial slits.

When the top is revolved and the lower disk is retarded, some very curious illusions will be produced. At times one part of the lower disk will appear to remain stationary, while the other part will appear to revolve. Again, the two series of radial bars will appear to rotate in opposite directions. Viewed in another way, they appear curved.

By replacing the slitted disk with the perforated disk (Fig. 3), and arranging the perforated disk so that it may be retarded by the friction of the finger, some curious effects will be seen. The different rows of holes will appear to advance and recede

(*Continued on page 244.*)

EXPERIMENTS WITH THE SCIENTIFIC TOP.

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Contents.

(Illustrated articles are marked with an asterisk.)

Anaconda, large..... 248
Balloon trip from Cherbourg to London*..... 249
Books and publications, new..... 251
Business and personal..... 251
Cabbage flies and worms..... 245
Carriages, care of..... 241
Cloths, waterproofing..... 247
Coal formation, new theory of... 245
Cocoa palms as lightning conductors..... 246
Electric lamps for mines..... 250
Engines of the paddle steamer Ozone*..... 243
Fearless, the..... 241
Foolhardiness..... 248
Game carrier, Stevens'*..... 245
Highways, public, use of..... 244
Home, a, the incentive to own a. 248
Inventions, agricultural..... 251
Inventions, engineering..... 251
Inventions, index of..... 251
Inventions, miscellaneous..... 251
Lamps, electric, for coal miners.. 250
Looms, stop motion for*..... 244
Mining experiments, submarine. 248
Mortar, monster, "Fere," the.... 240
Nitrate of soda..... 244
Natural history notes..... 250
"Noble forehead" fallacy, the.. 247
Nature the great teacher..... 240
Notes and queries..... 251
Ore concentrator, Channell's*... 242
Passenger depot of the Erie Railroad*..... 246
Patent rights as property..... 248
Patents, points on..... 247
Photographic notes..... 241
Photography, phosphorescent... 241
Photo printing on silk..... 245
Pneumatics with a steam vacuum, experiments in*..... 247
Rafters, lengths and bevels of, instrument for obtaining*.... 242
Railway track system, Noonan's* 242
Route taken in balloon trip from France to England*..... 249
Socialism, Petroleum V. Nasby on..... 250
Steamers, fast, at low cost..... 241
Stethoscope, vibrating, Blodgett's*..... 248
Sulky, saddle, Stillman's*..... 248
Telephonic induction..... 245
Tin, aluminum..... 242
Toboggan, improved*..... 243
Tool, riveting, Stevens'*..... 242
Top, chameleon*..... 239
Top, scientific, experiments with*..... 239, 244
Tree growth after girdling, remarkable..... 240
Type-writer, cheap*..... 246
Vinegar sharp, what makes..... 241
Wages, rise of, the century's..... 240
Women, scientific..... 244

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 568.

For the Week Ending October 16, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—Comets and Meteorites.—By RICHARD A. PROCTER.—A discussion of the origin of these bodies, in support of the writer's theory and in answer to Professor Newton's criticism thereof..... 8997

II. CHEMISTRY.—Alkaline Chromates.—Note on the twofold function of chromic acid.—Interesting as affecting battery solutions.... 8994
A Method of separating the Two Isomeric Toluidine-Sulphonic Acids.—By E. A. SCHNEIDER..... 8994
Liquid Carbonic Acid.—Manufacture and distribution as practiced in Berlin, according to Dr. Raydt's process.—3 illustrations... 8994
Nitrates and Nitrites in Waters and Artificial Solutions..... 8996

III. ELECTRICITY.—Absolute Electrometer for measuring Very High Potentials.—By E. BICHAT and R. BLONDOT.—A balance electrometer by which very high electrostatic potentials can be measured.—1 illustration..... 8991
Another Electric Launch..... 8991

IV. ENGINEERING.—Economical Quay Walls.—Description and full details of construction of the Rouen quay wall, and comparison of the same with the New York piers on the Hudson River.... 8990
Improvements in the Manufacture of Gas.—The Stedman-Stanley furnace; a review from *La Nature* of this American invention.—1 illustration..... 8987
The Stampede Pass Tunnel on the Northern Pacific..... 8989
The "Trompe," or Hydraulic Blower.—Interesting account of this historical blowing machine, formerly in use in connection with Catalan forges.—1 illustration..... 8990

V. GEOLOGY.—Earthquake Recorders for Use in Observatories.—By J. A. EWING.—2 illustrations..... 8997

VI. MATHEMATICS.—Radii of Curvature Geometrically Determined.—By Prof. C. W. MACCORD, Sc.D.—No. V.—The epicycloid, hypocycloid, and epitrochoid.—5 figures..... 8985

VII. MECHANICS AND TECHNOLOGY.—Colors of Metals and Alloys.—Abstract of Prof. Roberts-Austen's lecture before the British Association..... 8993
Grindstones.—By JOHN HARDISTY.—Valuable suggestions as to management, and more especially the turning up of grindstones.—1 illustration..... 8986
Sulphuric Acid in Refined Petroleum and Distillate.—Tabular statement of determinations of sulphuric acid in different oils, and discussion of the results..... 8994
The Hubner Carding Engine and the Modifications that have been Introduced into It.—A complete review of this subject, very fully illustrated by 13 figures..... 8983
The Laffite Process of Welding Metals.—By WILLIAM ANDERSON, M. Inst. C.E.—A new method of applying the flux in welding. 8986
Wire Stitching Machine.—Machine for use in box making, pamphlet binding, etc.—2 illustrations..... 8989

VIII. MISCELLANEOUS.—Barefoot Horses.—Advocacy of the non-shoeing of horses..... 8998
Coral Fishing.—Interesting account of the Mediterranean coral fishery and of its mercantile importance and prospects..... 8996
French Pointers.—Note on the Paris dog show.—1 illustration.... 8997
Resonating Gongs.—Ingenious application of the resonator.—1 illustration..... 8986
The Philosophy of Soaring Birds.—By Prof. DE VOLSON WOOD.. 8991

IX. NAVAL ENGINEERING.—On the Progress and Development of Marine Engineering.—By WILLIAM PARKER.—A very lengthy and full review of this subject in all its aspects.—7 figures..... 8987
The Fastest Sea Boat in Existence.—An ocean-going torpedo boat built for the Chinese Government..... 8989

X. PHYSIOLOGY.—Why Some People Grow Fat.—By N. A. RANDOLPH, M.D.—The chemistry and theory of the subject, and practical views.—One of the fullest discussions on the subject that has ever appeared..... 8995

XI. PHYSICS.—Capillary Attraction.—By WILLIAM THOMSON.—Conclusion of this lecture, the most important of the recent contributions to the subject.—Illustrated by 18 figures..... 8992
Soap Bubbles.—Report of Prof. Rucker's British Association lecture.—Interesting sequel to Prof. Thomson's lecture on capillarity 8993

THE "FERE" MONSTER MORTAR.

Some details have come to hand concerning the new Fere gun from which the French expect so much. It is, we learn, a mortar of unusual size, throwing twelve shells with more than ordinary precision for its type. The shells are a trifle over three feet in length, and contain an explosive said to possess extraordinary power of destruction. At a recent trial at Malmaison, the superiority of this gun over all others of its class was clearly shown, if the reports are trustworthy. It tore up masses of rock and shattered steel plates which would have proved an effective barrier to similarly constructed guns with which the military world is familiar. To the purely military mind perhaps the work it did when confronted with earthworks is the most interesting and important, for earthworks protected by steel armor have come to be looked upon as an effective defense, at least against all manner of mortar attack, even if impotent against the modern rifle at short range. The explosive projectiles of the Fere gun tore away the steel plating protecting a well constructed earthwork, and transformed into an indistinguishable mass the mounds that were expected to smother it.

The noise from the explosion of these shells is said to be terrific; and while, heretofore, the bark of the mortar shell has been regarded as worse than its bite before earthworks or heavy masonry, the Fere gun would seem to reverse this order of things, its sting being even more direful than its song. The reader will recall the great promise and little performance of Admiral Porter's mortar flotilla before Forts Philip and Jackson, in the Mississippi, during the civil war. Admiral Farragut waited patiently, or rather impatiently, with his fleet of gunboats lying idle in the tideway, while Porter essayed to reduce these works with his mortar play. Under so skillful an officer as Porter, the mortar boats may safely be said to have been placed most advantageously for the attack. A terrific fire of bombs was maintained for hours, and a very shower of these missiles fell in and about the works. But no great harm was done. The defending batteries were only temporarily silenced; and when the storm ceased, the gunners, who had been under shelter, returned to their stations, and it was seen that the aggressive power of the forts had not been perceptibly impaired. Satisfied of the impotence of mortar attack, Farragut now opened on the forts with his heavy guns, fough this way up the river, and took New Orleans.

Now, the Fere gun, it is alleged, is far more destructive than the ordinary mortar, but, like the latter, its range is short, and this will naturally tend to restrict its use. If the enemy would considerately abstain from using his big field pieces while it was in play, it might, perhaps, do great execution; but should he, while out of range of its projectiles, let drive at such a battery, it could not, save under peculiarly advantageous conditions, be worked at all.

It will be remembered how great was the disappointment of the French in 1870 with the performance of the mitrailleuse. It was a terrible engine of execution at close quarters, but these conditions were not always present; and when they were, the destructive work of the German long-range field pieces preceding the actual onset often resulted in rendering them valueless.

The Century's Rise of Wages.

Discussing wages, in one of his lectures before the students of Harvard University, Professor Thompson gives many facts of curious interest. In 1793 the Schuylkill and Susquehanna Canal Company advertised for workmen, offering $5 a month for the winter months, and $6 for summer, with board and lodging. The next year there was a debate in the House of Representatives which brought out the fact that soldiers got but $3 a month. A Vermont member, discussing the proposal to raise it to $4, said that in his State men were hired for £18 a year, or $4 a month, with board and clothing. Mr. Wadsworth of Pennsylvania said: "In the States north of Pennsylvania, the wages of the common laborer are not, upon the whole, superior to those of the common soldier." In 1797 a Rhode Island farmer hired a good farm hand at $3 a month; and $5 a month was paid to those who got employment for the eight busy months of the farmer's year.

A strong boy could be had at that time in Connecticut at $1 a month through those months, and he earned it by working from daybreak until eight or nine o'clock at night. He could buy a coarse cotton shirt with the earnings of three such months. The farmers could pay no better, for the price they got for produce was wretched. Butter sold at eight cents a pound, and when it rose suddenly to ten cents, several farmers' wives and daughters went out of their minds with the excitement. Women picked the wool off the bushes and briers, where the sheep had left it, and spun and knit it into mittens to earn $1 a year by this toilsome business. They hired out as help for twenty-five cents a month and their board.

By a day's hard work at the spinning wheel a woman and girl together could earn twelve cents. As late as 1821 the best farm hands could be had for twenty-five cents a day, or twice as much in mowing time. Mathew Carey, in his letters on the Charities of Philadelphia (1829), gives a painful picture of the working classes at that time. Every avenue to employment was choked with applicants. Men left the cities to find work on the canals at from sixty to seventy-five cents a day, and to encounter the malaria, which laid them low in numbers. The highest wages paid to women was twenty-five cents a day; and even the women who made clothes for the arsenal were paid by the Government at no high rates. When the ladies of the city begged for an improvement of this rate, the Secretary hesitated, lest it should disarrange the relations of capital and labor throughout the city. Poor people died of cold and want every winter in the city, and the fact seems to have made an impression only on benevolently disposed persons like Mr. Carey.

Nature the Great Teacher.

In his new book, "Nature's Teachings," the Rev. J. G. Wood has discussed a subject not before handled at length. Its object is to show how man's implements and mechanical devices have been anticipated in nature. He asserts that there is no invention of man which is not anticipated, that all his mechanical devices have been used in nature for countless centuries. He claims that the great discoverers of the future will be those who carefully study the natural world.

The burr stones of mills are a copy of molar teeth. The hoofs of a horse are made of parallel plates like a carriage spring. The finest file made by man is a rough affair when compared with a Dutch rush used by cabinet makers. The jaws of the turtle and tortoise are natural scissors. Rodents have chisel teeth, and hippopotami have adz teeth, which are constantly repaired as they are worn. The carpenter's plane is anticipated by the jaws of a bee. The woodpecker has a powerful little hammer. The diving bell only imitates the work of the water spider. This insect, although as easily drowned as any other, spends a great part of its life under water. Having constructed a small cell under the water, it clasps a bubble of air between its last pair of legs, and dives down to the entrance of its cell, into which the bubble is put. A proportionate amount of water is thus displaced, and when all of it is expelled, the little animal takes up its abode in this subaqueous retreat.

In laying its eggs on the water, the gnat combines them in a mass shaped somewhat like a lifeboat. It is impossible to sink it without tearing it to pieces. The iron mast of a modern ship is strengthened by deep ribs running along its interior. A porcupine quill is strengthened by similar ribs. When engineers found that hollow beams were stronger than solid ones, they only discovered a principle which had been used in nature for centuries before the creation of man. A wheat straw, if solid, could not support a heavy head. The bones of the higher animals, if solid, would have to be a great deal heavier to bear the weight which they have to support. The framework of a ship resembles the skeleton of a herring, and he who would improve aerial navigation might study the skeleton of a bird with advantage. Palissy made a careful study of the shells by the seaside, in order to learn the best method of fortifying a town.

The ship worm feeds on wood, and gradually tunnels its way through any submerged timber. It also lines its burrow with a hard, shelly coating. Brunel, taking a hint from this, was the first to succeed in subaquatic tunneling. The Eddystone Lighthouse is built on the plan of a tree trunk, and fastened to the rock in a manner somewhat similar to the way a tree is fastened to the soil. It is supposed that the first idea of a suspension bridge was suggested by the creepers of a tropical forest.

Mr. Wood gives an interesting account of the origin of the plan for the Crystal Palace. Mr. Paxton, a gardener, having noticed the structure of the great leaves of the Victoria Regia, a plant which had been introduced into England a few years previous, struck the plan of copying in iron the ribs of the leaf and filling the remaining space, which corresponds to the cellular portions of the leaf, with glass. Thus, by copying nature, an obscure gardener became Sir Joseph Paxton, the great architect.—*Wilmington Collegian.*

Remarkable Tree Growth after Girdling.

M. E. S. writes that on his farm in Vermont, in June, 1884, he attempted to kill a poplar tree by girdling. He removed a strip of bark about three inches wide entirely around the tree, at a place about four feet from the ground, scraping off the pulp that had formed between the wood and bark that year. The wood thus left bare seasoned over that summer, but the tree did not die, and has continued to grow till the present time, above the place where the bark was removed, but has not grown any below that. The measurements are given as 26½ inches in circumference above the place where the bark was removed, and 21 inches circumference below. The tree did not put out leaves quite as soon as the other trees near it, but it blossomed as full as any of the poplars around, and is said to be looking as healthy as they are.

PHOTOGRAPHIC NOTES.

To Prevent the Curling of Prints on Albumen Paper.—In the October number of the *St. Louis Photographer* we find the following practical hints on the above subject, suggested by Mr. John Vansant:

The great and forcible contraction which occurs in prints made on sensitized albumen paper, when they are dried after having been wet, can be prevented by the following very simple means: After having the prints fixed and all the hyposulphite sodium removed by sufficient washing, drain them well and press the water well out, then immediately immerse one by one in a solution of pure *glycerine* in *distilled water*, about 1 part of glycerine to 5 parts of water. Let them soak in this till thoroughly saturated; then remove them separately, and absorb the superfluous fluid by gentle pressure between clean sheets of white blotting paper. They can then be laid out flat, where they will dry without much shrinking, and be found smooth, soft, and with little or no tendency to curl.

These prints can then be mounted *dry* with paste or gelatine, and burnished as usual. The cards will remain perfectly flat.

To Remove Yellow Discoloration from Bromide Prints.—Should it occur after oxalate of iron development, I have found the best agent to be *oxalic acid*, about 3 grains to an ounce of distilled water. After fixing and washing out all the hyposulphite of sodium, soak the prints for a few minutes, or until the whites are bleached, in the oxalic acid solution. Then wash again thoroughly to remove the acid. This acid seems to have very little effect on the dark parts of the picture, and it can be applied in solution as above stated, successfully, to bleach the prints even after they have been dried.

Retouching Negatives.—In the same journal, J. H. Farmer gives the following advice on retouching:

Many photographers are in the habit of grinding their negatives. It is a great mistake. It is not necessary to either varnish, grind, or prepare your negative in any way. Simply use a metallic lead, and work right on the gelatine surface. The very finest effects can be obtained in this way.

To Change a Blue Print to Black.—Dissolve a bean of caustic potash in 5 ounces of water, soak the blue print therein until it fades to pale yellow. Wash. Dissolve a heaped teaspoonful of tannic acid in half a pint of water. Put in the yellow prints. Leave in until darkened to the color desired. Then wash thoroughly.

Phosphorescent Photography.*

In observing Mont Blanc after sunset, in the beginning of September, 1883, M. Ch. Zengler was impressed with the fact that the greenish blue light could be perceived as late as 10 h. 30 m. P.M. This led him to think that the ice on the summit, mixed with the debris of carbonate of lime, emitted a light similar in color to that of the water of Lake Leman, and that it would be possible to fix the image of the mountain, during the night time, by the phosphorescent light of the ice, which ice he found to be a highly actinic body.

On his return he performed an experiment consisting in projecting images by a photographic camera and lenses upon a plate of glass covered with Balmain's luminous paint, spread evenly over the surface, as if a photographic plate was to be covered with collodion.

After an exposure of a few seconds' duration, he took the plate from the camera into a dark room and placed it in contact with a photographic dry plate. After one hour's contact in darkness, he found that the image of the object appeared in all its detail, just as in the case of an ordinary exposure.

From his observations in Geneva, M. Zengler thought that carbonate of lime that had received the rays of a bright sun during the day might emit invisible, but very actinic, rays. Following out this order of ideas, he performed an experiment during the night of May 17, 1884, the sky being clouded. An exposure of the plate, about midnight, upon the terrace of the Astronomo-Physical Observatory of Prague, for a period of fifteen minutes, gave reasonably good images of towers and surrounding buildings, after a contact of the phosphorescent plate with the photographic plate, prolonged up to the morning of the following day. From this the author concluded that radiations were emitted, even by isolated bodies, that at midnight were quite actinic in the absence of all other light.

M. Zengler repeated, later, these experiments, using printed paper which he had exposed during the daytime to strong sunlight. After an hour's exposure, he placed it in contact with ordinary sensitized paper in the camera. In a few hours the impression of the paper was effected in such a way that development was not required, fixing alone being necessary, the letters appearing in plain black. M. Zengler has applied this method to copying printed notes.

These experiments led to the conclusion that light could be absorbed and slowly radiated afterward, and that images of bodies invisible in darkness could be fixed by simple contact or by photographic apparatus. The question then arose whether a number of the heavenly bodies, which are illuminated during greater or less periods, did not radiate back this light when they were immersed in darkness, in the form of actinic light, just as walls illuminated in the daytime gave up during night the light absorbed. If this surmise was correct, celestial chart makers could take advantage of it, for with a telescope of 8 inches aperture and 41 inches focus, a few seconds would suffice to print the phosphorescent plate, and to show stars even of the ninth degree of magnitude, when in darkness the phosphorescent plate thus acted on was brought into contact with a gelatino-bromide plate.

Quite recently the author has experimented with fluorescent bodies and with bodies sensitive to actinic light, such as uranates and nitrates of uranium; he thus obtained latent images that could be developed after several months had elapsed, provided that during this period they were kept in darkness and in perfectly dry air.

In conclusion, the images of many bodies can be obtained in darkness when, like carbonate of lime paper, etc., they possess the property of slowly giving out light absorbed during an exposure. Thus objects can be reproduced which up to the present time remained quite invisible to the eye, by making long exposures with lenses or mirrors of very short focus upon plates covered with phosphorescent or fluorescent substances, and by printing in darkness and for a long enough time upon a more or less sensitive bromide plate, either collodion or emulsion coated.

* Paper presented at the seance of the Academy of Sciences, Paris, August 30, 1886, by M. Ch. V. Zengler.

The Fearless.

This vessel, which is at present being fitted out by the Barrow Shipbuilding Company, from whose yard she was launched in March last, is the first of a very formidable type of torpedo cruisers which are being built for the English navy. The Fearless is expected to be ready for active service about November next. The vessel is 230 feet between perpendiculars, 34 feet extreme breadth, and 19 feet 9 inches depth of hold. Her displacement is 1,430 tons on a mean draught of 13 feet 6 inches, when completely equipped with armament, stores, and coal on board. She is propelled by twin screws, each screw being driven by an independent pair of engines of the collective power of 1,600 horses, giving an aggregate indicated horse power of 3,200 horses for both pairs of engines. The speed indicated by the Admiralty when the vessel was designed was 16½ knots, but the builders are confident that a much higher rate of speed will be attained during the forthcoming trials.

The gun armament consists of four 5 inch B. L. R. guns, mounted on Vavasseur's central pivoted carriages, eight Nordenfelt machine guns, and two Gardner guns. The torpedo armament consists of eleven torpedo tubes, or air guns, one fitted on the bow under water, and the others ranged along the upper deck. The gunners, when working the guns, are protected by shields revolving with the carriages, and those working the torpedo tubes are protected by steel plating in way of each torpedo port. Four air-compressing engines are fitted in the vessel for supplying motive power to the torpedoes, and for ejecting them. There are also two electric search lights of 20,000 candle power, supplied by a dynamo. The Fearless being unarmored, her safety as a war cruiser is secured by the engines, boilers, steering arrangements, magazines, and other vital parts being placed below the load water line in watertight compartments with a protective steel deck fitted over them. She can be steered from three different places, and, when in action, all her men can be put out of sight. The vessel is built of steel, and particular care has been taken to combine strength with lightness.

The Care of Carriages.

The editor of the *Wagon Maker* in a recent interview with a prominent Chicago carriage builder gained the following information relative to the care of all painted vehicles.

The Jehu's Decalogue or Ten Commandments, as he terms his ten "Don'ts," runs as follows:

1. Don't forget that the preservation of the colors of painting and lining of a carriage depends in a great measure upon the way in which it is housed. The barn should be airy and dry, with a moderate admission of light, otherwise the colors will be affected. Do not let the vehicle be rolled near a brick wall, as the dampness of the wall will fade the colors and destroy the varnish. Direct sunlight should not strike upon it through the windows, which should therefore be curtained or otherwise screened. The coach house should not be connected with the stable or next the manure pit, since the ammonia fumes rising from the stalings will do more to crack and ruin varnish, and ruin colors of paint and lining, than all other causes put together.

2. Don't be in too great a hurry to use your vehicle when you have it delivered—either at first or after it has been revarnished. The change of temperature from the factory to your coach house may—especially if you have been in a hurry to get possession of it—affect the varnish. Let it stand unused for some few days, washing it with cold water, drying off carefully, and letting it stand in the shade where cold air will circulate freely. This will insure the hardening and brilliancy of the varnish.

3. Don't use the same sponge and chamois leather for washing the panels and under parts and wheels of a carriage. When washing a carriage, keep it out of the sun. Take care not to wet the linings, if cleaning off with a hose. For washing the body panels use a large, soft sponge, well saturated, which squeeze over the panels, so that the dirt will flow off with the water as it runs down. Use a second sponge for the under parts and wheels, and carefully dry each part with its special chamois.

4. Don't allow mud to dry on a new or newly varnished carriage: spots and stains will be the invariable result if you do.

5. Don't use a spoke brush for cleaning the wheels and under parts of vehicles, even when you are tolerably confident that all mud has been removed. If any grit is left on either wheel or brush, it will scratch off the varnish and spoil the gloss as badly as if sandpaper had been used to do the work.

6. Don't allow water to dry of itself on a varnished surface, as this will produce stains. Remove all moisture with the chamois leather only, after the soft sponge has been used.

7. Don't use hot water or soap on a varnished surface.

8. Don't let leather-top carriages lie long unused with the top down, but raise it occasionally, taking off the strain on the leather and web-stay by slightly "easing" the joints. Frequently unroll the aprons also. If the leather is enameled, it may be washed occasionally with weak, soapy water—*not* first scrubbed with wetted soap—and the lather then removed with the hose.

9. Don't omit to take precaution against moths in cushions and linings. In the case of a close carriage, set a saucer of spirits of turpentine and camphor on the floor, draw up all the glasses and close the doors. This will prevent moths from doing damage, and often cure when neglect has to be remedied.

10. Don't neglect to examine the axles frequently. See that they are well oiled, and that the washers are in good order. When they require oil, use sperm oil, such as is always in the sewing machine drawer. Sweet oil will gum up, and should never be used. When putting on the axle nuts, be careful to fit the thread properly, not crossing or straining it. Occasionally inspect the entire vehicle. If a bolt or a clip seems getting loose, tighten it up at once with the wrench. If the tires of the wheels slacken, so that the joints of the felloes can be seen, have them shrunk at once; and whenever any little repair becomes necessary or even advisable, have it done at once, and by some one who knows how to do it.

Fast Steamers at Low Cost.

A new company has been formed to run steamers between Liverpool and the Isle of Man. The island is distant about 75 miles from Liverpool, and about equidistant from England, Ireland, and Scotland, and has of late years become one of the most important seaside resorts in the United Kingdom, the passenger traffic having increased to such an extent that there are frequently four or five boats dispatched with passengers from Liverpool to the island the same day. The company has arranged a conditional contract for two first-class screw steamers, handsomely fitted and furnished, having triple expansion engines of about 1,500 horse power, and to be fitted with bilge keels, which prevent rolling to a great extent. The dimensions will be: Length, 225 ft.; breath, 30 ft.; depth, 13½ ft.; which dimensions and power are largely in excess of the present screw steamers on this station, and the company further intend building a first-class winter or spare boat of smaller dimensions.

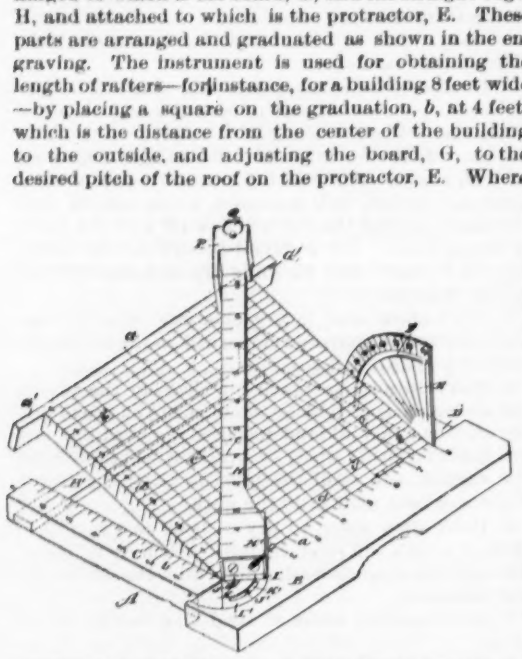
Messrs. Russell & Co., of Port Glasgow and Greenock, commenced the first steamer on the first of October, and she is to be ready for her station by next Easter. As an example of the low prices at which steamers may be had now, we may state that the contract price for the large steamers, which are to be built according to Lloyd's highest class as well as to the Board of Trade requirements, and to steam at 17 to 18 miles an hour, is only £18,500 each, subject to any alterations that may be considered necessary by the directors, and the price of the spare or winter steamer, the plans and specifications for which are now being prepared, will be about £10,000.

What Makes Vinegar Sharp.

George Adams, in 1747, said that some people have imagined that the sharpness of vinegar is occasioned by the eels striking their pointed tails against the tongue and palate; but it is very certain that the sourest vinegar has none of those eels, and that its pungency is entirely owing to the pointed figure of its salts, which float therein.

INSTRUMENT FOR OBTAINING LENGTHS AND BEVELS OF RAFTERS.

This instrument consists of a rectangular frame, A, hinged to which is the board, G, and the straight edge, H, and attached to which is the protractor, E. These parts are arranged and graduated as shown in the engraving. The instrument is used for obtaining the length of rafters—for instance, for a building 8 feet wide—by placing a square on the graduation, *b*, at 4 feet, which is the distance from the center of the building to the outside, and adjusting the board, G, to the desired pitch of the roof on the protractor, E. Where



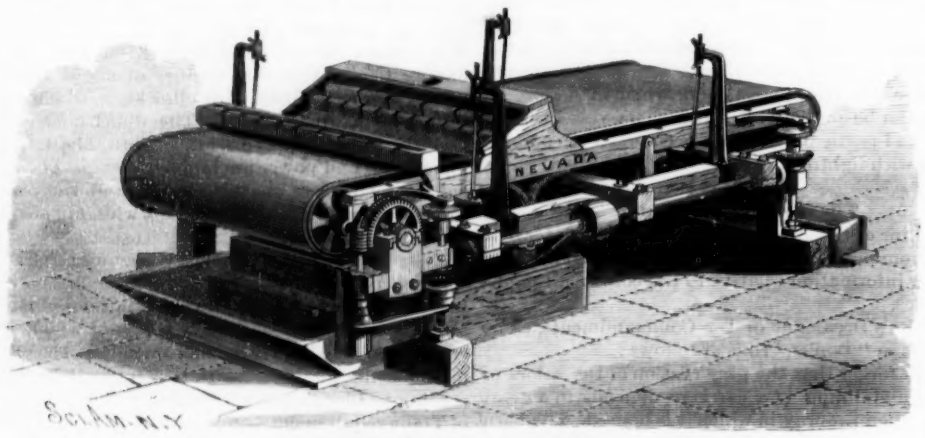
CONLEE'S INSTRUMENT FOR OBTAINING LENGTHS AND BEVELS OF RAFTERS.

the square touches one of the lines, *d*, on the board, the distance from there to zero indicates the length of the common rafter; and by following the respective line, *d*, across the board to the straight edge, which is set say at 45°, then the intersection of the lines, *d*, at the graduation, *e*, of the straight edge gives the length on the scale, *e*, of the hip rafter. By following the line, *e*, which intersects the line, *d*, and scale, *e*, down to the scale, *a*, then the latter indicates the length of the jack rafter. The instrument is also adapted for accurately and quickly obtaining the bevels for jack, common, and hip rafters, and for obtaining the bevel across the face of the stuff for splay or hopper work, and also the miter across the edge of stuff for splay or hopper work.

This useful instrument is the invention of Mr. Harrison Conlee, of Petersburg, Ill.

ORE CONCENTRATOR.

The object of this invention, which has been patented by Mr. John D. Channell, of Nevada City, California, is to provide an ore concentrator simple in construction, and which will effectively concentrate the heavy and light particles of the precious metals. The main driving shaft extends along one side of the machine, and at each end is provided with a beveled gear engaging with a similar gear on an upright shaft. At the upper ends of these shafts are cranks and pins, to which are attached rods securely fastened to the frame carrying the belt. The belt frame hangs on four swings, and is easily given a rotary motion. At the lower ends of these swing rods are screws, whereby the belt frame can be adjusted up or down, so as to bring the belt perfectly level. There are four large and twelve



CHANNELL'S ORE CONCENTRATOR.

small rollers over which the belt travels. The one at the head of the machine drives the belt by means of a screw gear and vibrating connection. The next roller carries the belt down into a box containing water, where the gold and other metals are washed off. The next roller acts as a tightener and also raises the belt higher than the end one, so that the sand and water will not run back under the machine. The fourth large roller is at the rear of the machine. The twelve small rollers are placed under the belt on top of the frame, to give a smooth surface to the belt.

The machine is run by a driving pulley placed at about the center of the main shaft. The feed gear is worked by means of a belt on cone pulleys, as shown in the engraving.

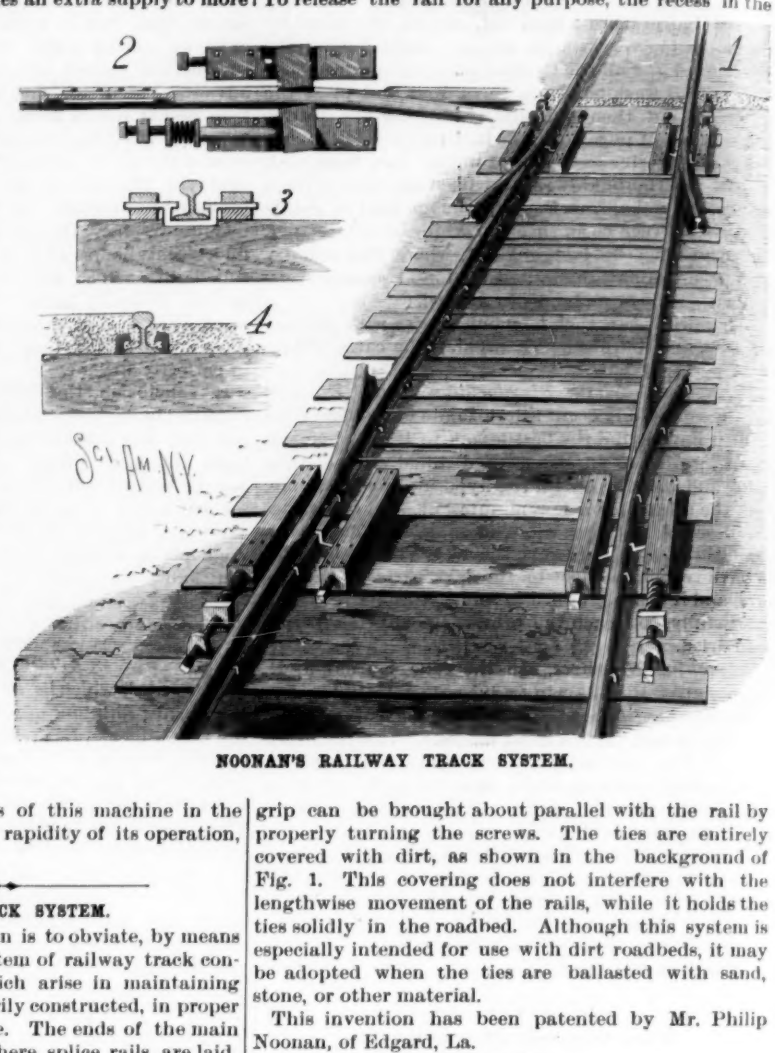
The pulp or sand from the battery is delivered to the machine through a hole in the center of the distributer, and is spread evenly over the belt. The water distributer on the front furnishes an extra supply to more effectually wash out the sand.

Each edge of the rubber belt is provided with a rubber tube or hose, of such size as to prevent the water and sand from running off. This construction insures durability, as the flexibility of the belt allows it to easily pass over the rollers without danger of breaking.

It will be seen that this concentrator is simple in construction, and does not require a thoroughly experienced person to operate it. The easy rotary motion of the belt carries gold sulphurets and all heavy metals to the bottom, and holds them there while the sand is washed away. As this rotary motion is smooth and continuous, the belt can be run faster than in those machines having a vibrating movement, while it washes the sand away quicker and saves lighter and finer dust. It also requires a minimum amount of power to work it. Tests have shown the advantages of this machine in the quantity of metal saved, the rapidity of its operation, and small power required.

RAILWAY TRACK SYSTEM.

The object of this invention is to obviate, by means of a simple and efficient system of railway track construction, the difficulties which arise in maintaining the rails of a track, as ordinarily constructed, in proper surface and to correct gauge. The ends of the main rails are turned outward where splice rails are laid, as represented in Fig. 1. The splice rails are beveled at the ends, so as to lie closely to the inner sides of the main ones, and form therewith continuous rails, and are located at places where the accumulation of the "waves"—which cause "creeping"—in the rails would reach a dangerous limit, as at crossings at grade, at the base of heavy inclines, and at frogs and draw bridges. The ends of the main rails are set close together, no separation being made to allow for expansion, as in the usual construction, and are connected by fish plates which do not allow for lengthwise movement of the rails. The spikes are not driven as far as possible, a space of about half an inch (Fig. 4) being left between their heads and the rail flanges, which are not notched to receive the spikes. The splice rails have notches in their flanges through which spikes are driven so that their heads



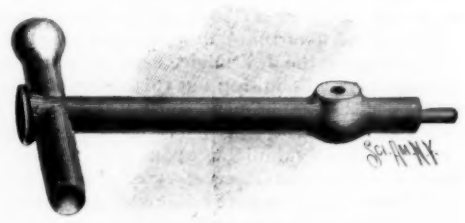
NOONAN'S RAILWAY TRACK SYSTEM.

may be compressed by a properly arranged screw. The recess of the grip is a little wider than the rail base, so that, when the pin is forced inward by the screw, the grip will be turned to cause diagonally opposite edges to clasp the rail and prevent its backward movement, while allowing a forward movement. To release the rail for any purpose, the recess in the grip can be brought about parallel with the rail by properly turning the screws. The ties are entirely covered with dirt, as shown in the background of Fig. 1. This covering does not interfere with the lengthwise movement of the rails, while it holds the ties solidly in the roadbed. Although this system is especially intended for use with dirt roadbeds, it may be adopted when the ties are ballasted with sand, stone, or other material.

This invention has been patented by Mr. Philip Noonan, of Edgard, La.

RIVETING TOOL.

The construction of this tool is very clearly shown in the figure herewith presented. On one end of the shank or body portion is a punch about the size of an ordinary copper rivet, and on the other end is a suitable boss to receive the blows of a hammer. One end of the head piece has a concavity shaped to give a proper form to the upset end of the rivet, and at the other end is a boss for striking upon. To use the tool, the parts to be united by rivets are first pierced by the punch, when the rivet is inserted and the usual washer put on. The projecting end of the rivet is then placed in the hole in the shank of the tool, when the stroke of a hammer forces the washer down tightly to the work. The concavity is then placed over the end of the rivet, which is then upset and given a neat convexed finish by blows delivered upon the opposite end of the head piece. The punch may be made removable, and the hole in the shank may be formed in a removable sleeve, to adapt the tool for use in setting rivets of various sizes.



STEVENS' RIVETING TOOL.

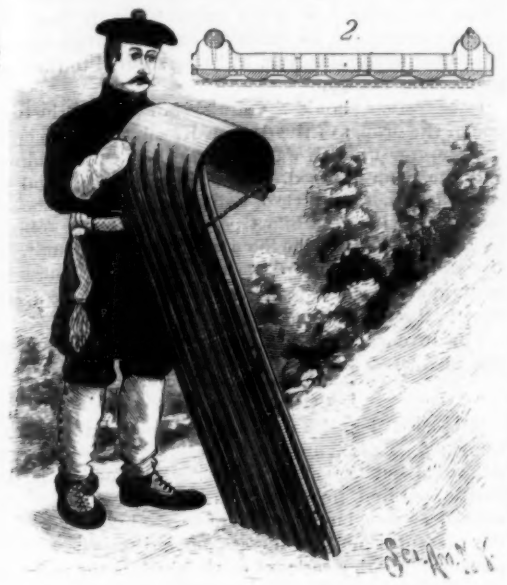
This handy riveting tool is the invention of Mr. James H. Stevens, of Grover, Col.

Aluminum Tin.

The applications of aluminum are now considerable, and M. Bourbouze, a French physicist, has added to their number by employing an alloy of the metal with tin for the internal parts of optical instruments in place of brass. The alloy he employs consists of 10 parts of tin and 100 parts of aluminum. It is white, like aluminum, and has a density of 2·85, which is a little higher than that of pure aluminum. It is, therefore, comparatively light, which is an advantage for apparatus where lightness is desired. It can be soldered as easily as brass, without special means, and it is even more unalterable than aluminum to reagents.

IMPROVED TOBOGGAN.

The slats forming the bottom of the toboggan are made with their middle parts raised longitudinally and rounded, and with flat flanges along their side edges, forming a ribbed surface. The slats are secured to the cross pieces by nails, screws, or rivets passing through the side flanges as shown in the cross sectional view, Fig. 2. The slats may also be held by screws passing through the cross pieces and into their thicker middle parts. The forward ends of the slats are curved to give the usual shape to the front end



CLAPP & AINSWORTH'S IMPROVED TOBOGGAN.

of the toboggan. The hand rails are supported by projections on the upper sides of the end parts of the cross pieces. The forward ends of the side bars are left free to give the requisite elasticity to that end of the toboggan. The front corners of the toboggan are connected with the side bars by cords in the ordinary way. This construction forms a bearing surface free from screw or rivet heads or countersinks to cause friction and scratch the ice, and will polish easily and quickly. It is claimed that this toboggan will run faster and wear longer than those made in the usual manner. This invention has been patented by Messrs. B. W. Clapp and S. Ainsworth, of 75 Putnam Street, Saratoga Springs, N. Y.

GAME CARRIER.

Mr. James H. Stevens, of Grover, Colorado, has recently patented an inexpensive device by which game can be conveniently and safely carried from an ammunition pouch or belt. It consists essentially of a heavy steel wire, bent as shown in the engraving. The edge of the holder or pouch is secured to the inner part of the carrier in any approved way. The ends of a strap, by which the combined carrier and holder is swung from the shoulder of the sportsman, are attached to eyes formed by the upper parts of the wire. These eyes are large enough to allow the heads of game to be passed through them into the spaces between the wires, which are small enough to hold the game by their necks. About at the middle of each side of the carrier is a hook, which, when closed, serves as a brace for the sides of the carrier and also as a support for a small quantity of game, which is thus held as high as possible from the ground, to prevent it dangling about the sportsman's legs. By slightly modifying the construction, this carrier can be applied to an ordinary cartridge belt.

STEVENS' GAME CARRIER.

ENGINES OF THE PADDLE STEAMER OZONE.

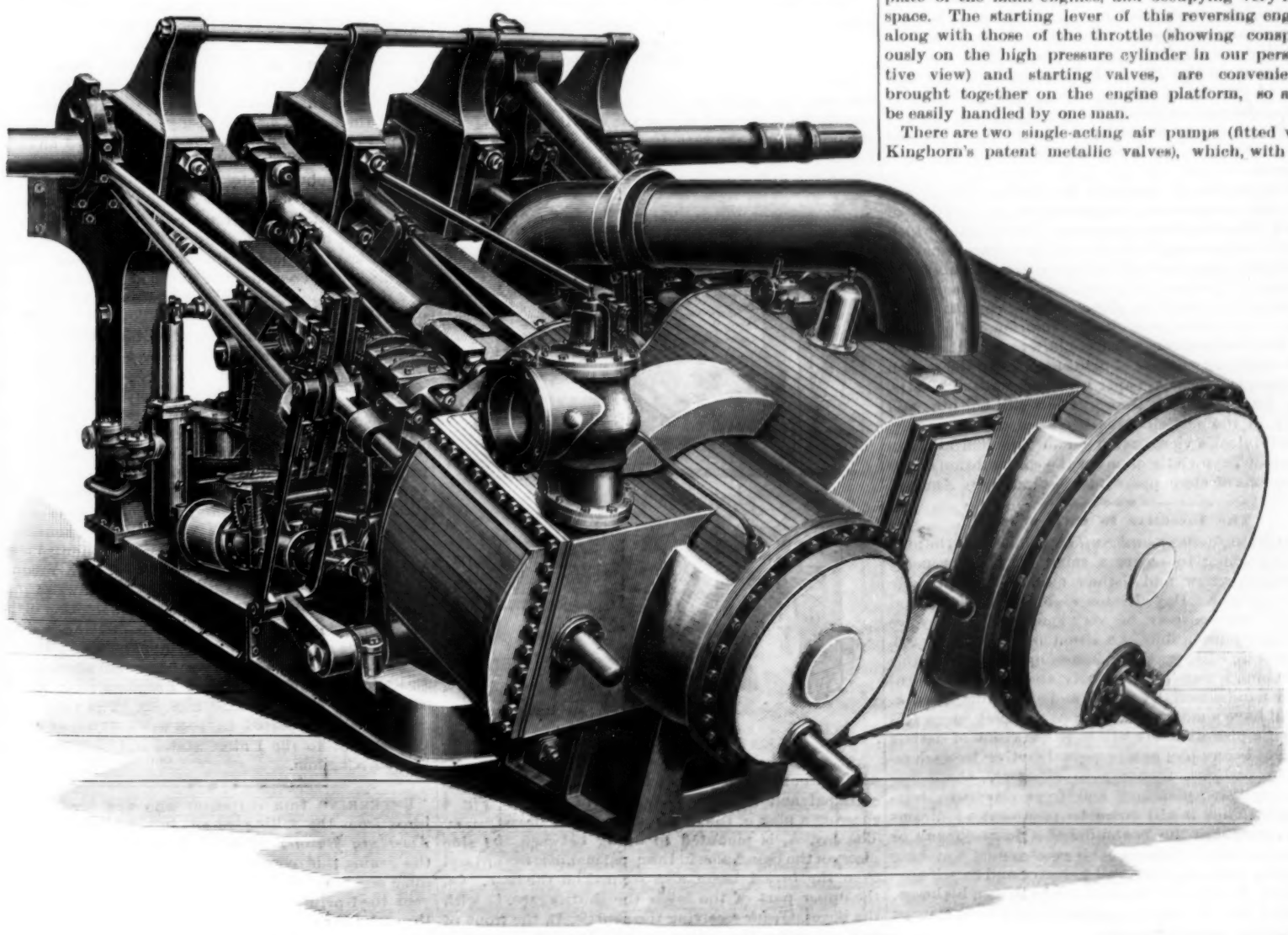
We give a perspective view, from *Engineering*, of the engines of the paddle steamer Ozone, constructed by Messrs. Rankin & Blackmore, of Greenock.

The Ozone was built to the order of the Bay Excursion Company, of Melbourne. The Ozone is 260 feet long between perpendiculars, and has a moulded breadth of 28 feet, and a depth of 11 feet 2 inches, with a plate keel, and the accommodation on her three decks is so arranged that she could, on a push, carry the enormous number of 3,000 passengers.

The engines of the Ozone are of the direct-acting diagonal compound type, and are of 314 nominal horse power (Clyde rule), having two cylinders 47 inches and 85 inches in diameter, the stroke being 5 feet 6 inches. In designing these engines, Messrs. Rankin & Blackmore's effort was to make the machinery as light as possible, consistent with ample strength, and to this end the almost universal exhaust steam jacket round the high pressure cylinder was dispensed with, a jacket being substituted, thus effecting a considerable saving of weight. The exhaust pipe from the low pressure cylinder to the condenser is also made of copper, as against the usual practice of cast iron; and the condenser itself is a cylindrical casting with light malleable iron doors lying snugly beneath the diagonal framings. Messrs. Rankin & Blackmore have hitherto designed their diagonal framings of cast iron, box section, but in this case they are of solid forged malleable iron, with round flanges at the cylinder end, and T heads for attachment to the main framings, which, by the way, are connected to the cylinders at their bases by box-section tie pieces of cast iron.

The connecting rods are of the double jawed type at the piston rod end, and are coupled to the crank pins by solid single jaws fitted with gun metal bushes having extra large surface. The valve motion differs from that of most paddle engines in having double plate links in lieu of the usual open quadrants, and the eccentric rods have forked ends with large adjustable bushes. The high pressure cylinder is fitted with a single-ported, and the low pressure cylinder with a double-ported, valve. The reversing is performed by one of Brown's steam and hydraulic engines of the newest design, working horizontally from the bed plate of the main engines, and occupying very little space. The starting lever of this reversing engine, along with those of the throttle (showing conspicuously on the high pressure cylinder in our perspective view) and starting valves, are conveniently brought together on the engine platform, so as to be easily handled by one man.

There are two single-acting air pumps (fitted with Kinghorn's patent metallic valves), which, with the



COMPOUND ENGINES OF THE STEAMER OZONE.

feed and bilge pumps, are worked from the piston rod cross heads by means of drag links and bell cranks arranged so that the various buckets and plungers serve to counterbalance, to a considerable extent, the weight of the high and low pressure cylinder pistons, thus practically doing away with the unpleasant jerk so noticeable in many paddle boats. The water for condensing the exhaust steam is circulated through the condenser tubes by one of Gwynne's "Invincible" pumping engines, capable of discharging over 3,000 gallons per minute.

The paddle shafting is all forged of "double wrought" iron for extra strength, and the paddle wheels are of the ordinary description, each having nine feathering floats of wood. The diameter of the wheels is 21 ft. 10 in. over all, and 47½ revolutions were easily obtained; but owing to the unusual severity of the specified trial (viz., four consecutive runs between the Cloch and Cumbrae lights, 15·744 statute miles), and the firemen not being accustomed to forced draught, the average number of revolutions on the trial trip was half a revolution less, viz., 47, and resulted in a clear mile of additional speed over the 20 miles guaranteed; for the time taken to run the "lights" was exactly a mean of 45 minutes, or as nearly as possible 21 miles per hour, the engines indicating 2,680 horse power.

This gratifying result was very much due to the saving of weight effected by the adoption of the "navy" boilers in conjunction with forced draught supplied by two of Capell's fans driven by Chandler's high speed engines, which worked very quietly and satisfactorily, giving an air pressure equal to 1½ in. of water with ease, but on trial ⅞ in. only was required, thus leaving a liberal margin for the inferior Australian coal, which from their extensive colonial connection Messrs. Rankin & Blackmore have found requires much larger boiler power than is necessary with our own good steam coal.

There are six steel boilers in the Ozone, 7 ft. 9 in. in diameter and 15 ft. long, with a working pressure of 90 lb.

Scientific Women.

An agreeable illustration of the capacity of the feminine mind to grapple with the abstractions of science was afforded in the recent annual meeting of the American Science Association, whose proceedings were illuminated by the personal participation of several lady members. A paper by Mrs. Nuttall Pinart was read, in the section of anthropology, containing some analyses of Mexican inscriptions. The novelty of her interpretation consists in interpreting the Mexican symbols as phonetics and not as ideograms, thus completely revolutionizing the previous conceptions on this subject. Her method has been applied to the deciphering of calendar and sacrificial stones of Mexico, and was suggested by the presence on these of phonetic symbols occurring in picture writings. This so-called calendar stone Mrs. Pinart believes to be the market stone of the city of Mexico. It regulated the time of holding the market days; and perhaps the division of the Mexican year rested upon these times. It also gives evidence to the existence of a communistic government.

In the section of chemistry, Mrs. Helen C. De S. Abbott read a paper upon the proximate composition of a bark from Honduras, known as "chichipati," which contains a new camphor and a yellow coloring matter, chichipatin, apparently of value as a dye and substitute for fustic. The same lady also presented some considerations of the relations of the chemical constituents of plants to their morphology and evolution, maintaining that the chemical constituents follow parallel lines with the evolutionary course of plant forms. In the section of economic science, a paper was read, written by Mrs. John Lucas, of New Jersey, upon silk culture; and finally, in the section of mathematics and astronomy, Anna Winlock's views were read on "the limitations in the use of Taylor's theorem for the computation of the precessions of close polar stars."—*American Analyst.*

The Incentive to Own a Home.

The *Manufacturer and Builder* thinks that the man who is working to secure a small piece of property substitutes a new and distinct ambition for a remote and vague one. Day dreams about large estates and princely incomes may be very amusing, but they are not half so profitable as a vision of a lot 100 by 200, with a snug little dwelling house upon it. With this before him, a man will rise early and retire late, turning his hand cheerfully to any and every kind of work. He will have a motive for rigorous economy which will make it a pleasure. He will have the vision of the last payment before him as a perpetual motive to moderation in passions, economy in expenses, abstinence from expensive pleasures and from expensive companions. Thus it will come to pass that a judicious debt, incurred at the beginning of a journeyman's or laborer's career, will become his good genius, watching over him, inciting him to all industry and to self-government. Every laboring man ought to own his house. The first duty of the workingman should be to convert his earnings into real estate.

EXPERIMENTS WITH THE SCIENTIFIC TOP.

(*Continued from first page.*)

in a very erratic way. Figs. 12 to 15 inclusive illustrate the well known and very interesting toy known as the chameleon top. This top is shown in this connection, as the beautiful experiments which have been adapted to it may be transferred with great advantage to the heavier top. Fig. 12 shows the top itself, with the black sector lifted out of its normal position to show the colored segments on the face of the top.

When the top is spun with the black sector resting on its face, a great variety of changes of hue may be produced by retarding the sector, by touching the metallic radially ribbed disk attached to its center. This operation causes it to shift its position on the top, and expose the different colored segments in succession. Persistence of vision causes the segments to appear as circular bands of color, which constantly change.

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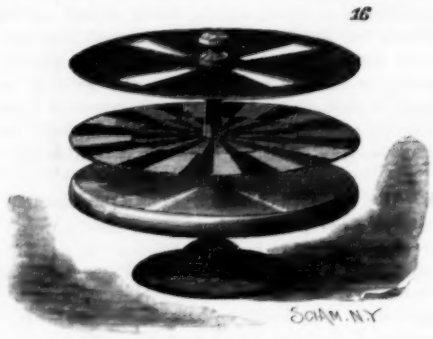


RADIAL DISKS.

When the colored paper ellipses shown in Fig. 13 are thrown upon the top and touched by the finger, the colors are curiously blended.

The tricolored disk shown in Fig. 14 is to be supported loosely on one of the wires shown in Fig. 15. This disk, when revolved, yields some very pretty effects. The wires shown in Fig. 15, when inserted in the hollow top spindle and revolved, produce the figures shown in the upper portion of the engraving, appearing like phantom vases, bowls, etc.

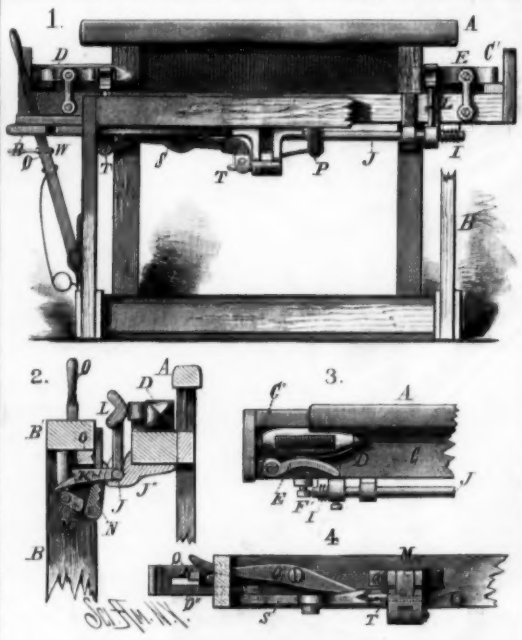
When this experiment is adapted to the large top, the wires are replaced by thin nickel plated tubes, inserted in wooden pins fitted to the spindle of the top. The tubes are provided at their upper ends with small spherical knobs.

In addition to the experiments described, there are of course many others of equal interest which may be performed by means of a heavy top.

The spinning device shown and described in the first paper has been adapted to a large gyroscope.

A STOP MOTION FOR LOOMS.

The invention herewith illustrated provides a construction by which the belt is automatically shifted and the loom stopped in case the shuttle fails to leave the box. Fig. 1 shows a front view of the lay of the loom, or the swinging frame, by the movement of which the weft threads are laid parallel to each other against the cloth previously woven, Fig. 2 being a cross sectional and Fig. 3 a plan view of the lay; Fig. 4 showing a plan of the under side of the breast beam. The lay, A, is mounted to swing between the side pieces of the base frame in the usual manner, toward and from the breast beam, also secured on the base. On the upper part of the lay is the shuttle race, C, with the boxes, C', for receiving the shuttle, D, the front of each box being formed by a curved lever, E, pivoted at the outer end of the lay in such a manner as to swing toward and from the back of the lay, the lever being pushed inward by a spring, F. In lugs on the front of the lay is journaled the shaft, J, the middle of which is supported by a forked piece, J', between the prongs of which projects a dagger, K, that acts against the bunter, O, and a supplementary bunter, N. Arms, L, project upward from the shaft, their heads resting against the outer swinging ends of the levers, E, and springs, I, being coiled around the ends of the shaft, each having one end resting against the adjacent arm in such way as to press the arms against the levers, E. From the under side of the breast beam, B', jaws, M, project downward, to which the supplementary bunter is pivoted, a spiral spring, P, being secured to the supplementary bunter.



MEGSON'S STOP MOTION FOR LOOMS.

In operation, should the shuttle fail to enter the box, one of the prongs of the dagger, K, will strike the ordinary bunter in such way that the belt will be shifted and the loom stopped. By the previous method of construction, if a shuttle of a single-shuttle loom should fail to leave its box while a pattern was being formed by the harness, and the loom was allowed to run, both the take-up and the pattern chain would require adjusting, and with a loom employing more than one shuttle the warp threads would be broken.

This invention has been patented by Mr. John Megson, of Adams, Mass.

Nitrate of Soda.

Extensive deposits of nitrate of soda exist at Antofagasta, Taltal, and other places in the desert of Atacama, but the chief center of production is the newly acquired province of Tarapaca, which is described as one immense bed of this valuable salt. At the present time the nitrate business appears to be passing through a series of crises which is the result of two distinct causes. A commission appointed by the United States Government to inquire into the industrial and commercial condition of the Central and South American States, writing on the subject of the nitrate deposits, says that, in 1875, the Peruvian Government appropriated the nitrate deposits of Tarapaca, and compelled the proprietors of works to hold them under leases from the Peruvian Government, and to produce nitrate subject to the payment of a royalty, but the production was limited to a certain specified quantity per annum. The object of the Peruvian Government in appropriating the nitrate deposits, and in limiting the production, was to prevent nitrate competing with guano as a fertilizer.

When Chili took possession of Tarapaca, the works belonging to the Peruvian Government were sold, those which had been seized, but not paid for, were restored to their rightful owners, and the production of nitrate was declared to be free. A considerable impetus was thus given to the production, which was already in excess of the demand, when, rather more than a year ago, a sudden collapse in a large consuming market brought about a crisis in the nitrate business. About three years ago the beet growers commenced to use nitrate as a fertilizer. The roots attained an enormous size, and the quantity produced per acre far exceeded that obtained by any other fertilizer. Experience, however, soon demonstrated that, although the beet roots attained an unprecedented size under the influence of nitrate as a compost, it was at the expense of the saccharine matter contained in the root, and it was also discovered that the salt had a deleterious effect upon the sugar in the act of granulation, and even upon the sugar itself.

The result of this discovery has been the refusal of the best sugar producers to purchase roots to which nitrate had been applied. To meet this altered condition of affairs, the nitrate producers combined not to produce more than 10,000,000 quintals per annum; and with the object of finding a new outlet for their production, the owners of nitrate works agreed to offer a prize of £1,000 to the discoverer of a new use for nitrate, and they also purposed distributing among agricultural societies, institutes, and schools 500 tons of salt for experimental purposes. A considerable quantity of iodine, for which practically there is an unlimited market, is obtained from nitrate, but as it is a residual product, the quantity obtained obeys the laws of production of nitrate. The iodine is held in solution in the water in which the nitrate earth is boiled and washed, and the reagent used is sulphuric acid. The total value of the nitrate of soda exported in 1883 amounted to £6,409,000, of which the United Kingdom took £5,878,000, and the United States £168,000. The total value of the iodine exported in 1883 was £597,000, of which £90,000 went to the United States and £355,000 to the United Kingdom.

REFERRING to a carpenter who was seriously injured from the falling of an insecure scaffold, the *American Builder* adds: "It seems too bad, with the genius this country affords, that it cannot find some one who will invent a scaffold which will prevent the fearful loss of life which is daily occurring through the carelessness of those who build the ordinary joist and board affair."

Cabbage Flies and Worms.

From the address of President William Saunders, before the Entomological Society of Southern Ontario, we learn that the cabbage crop has been materially injured by the ravages of the cabbage Anthomyia, *Anthomyia brassicæ*, a two-winged fly, which in the larval state burrows in the center of the stem of the young plant and causes its death. This cabbage insect is a native of Europe, is very troublesome in Britain, and has been known as a very destructive insect in this country for about thirty years, but nothing is known either of the date or the method of its introduction. The flies appear in the spring, and deposit their eggs upon the stems of the young cabbages about or a little below the surface of the ground. The eggs hatch in about ten days, when the young larvæ usually bore into the interior and work their way down toward the root; sometimes they merely gnaw grooves on the outer surface of the stem, and by this find their way to the roots, on which they feed. When full grown they change to yellowish red chrysalids in the earth, from which the flies shortly escape, the whole period of their life history, thus briefly traced, occupying about eight weeks. Usually, the plants attacked soon wilt and finally die. It is believed that there are two or three broods of these insects during the year.

Several remedies have been recommended, such as dipping the roots and stems of the young plants in strong lye, or a mixture of earth and cow dung diluted with water, or a thick mixture of soot and water. Any bitter or alkaline substance which would adhere well to the outer surface would probably deter the flies from depositing their eggs. Lime added to the soil, in the proportion of 100 to 150 bushels to the acre, after plowing, and well harrowed in so as to keep it near the surface, has proved a very effectual preventive measure; or even where the insects are at work upon the plants, if the earth is scraped away from about the stem of each, and a handful of lime dusted around it, and the soil again drawn up to the stem, the plants will sometimes recover. Coal dust, gas lime, and stimulating artificial manures have also been recommended.

The cabbage has also suffered from injuries caused by the common cabbage worm, the green caterpillar of the cabbage butterfly, which feeds upon the foliage, and often disfigures it to such an extent as to render it unmarketable. The habit of this caterpillar, feeding as it does among the folds of the leaves, makes it extremely difficult to reach with any sort of poison without at the same time rendering the cabbage unfit for use.

PYRETHRUM, OR INSECT POWDER.

Pyrethrum, or insect powder, which is the powdered flowers of *Pyrethrum cinnerariafolium*, has been used with good effect, either dusted on the plants or mixed with water and applied to them with a syringe, and this remedy is not in any way objectionable or poisonous. The pyrethrum plant is in my experience quite hardy in Ontario, has stood the severe cold of the past two winters without injury, and flowered freely. It is easily raised from seed, and being a perennial species, when once established it will continue to flower for an indefinite number of years. The flowers, collected when just about to expand, dried, and powdered, are very efficient as a general insecticide.

During the past year or two, many interesting experiments have been made and valuable results obtained in the way of artificially introducing disease among communities of caterpillars, a sort of caterpillar plague or pestilence, which carries them off by thousands. There is a very fatal disease which appears from time to time among silkworms, the larvæ of *Bombyx mori*, when bred for the production of silk, a disease which spreads so rapidly that it frequently destroys entire broods of caterpillars within a few days. So destructive has it been, that it is estimated that the silk crop in Europe is injured to the extent of many millions of dollars annually. During the past ten years it is believed to have reduced the income of silk breeders twenty-five per cent, and in 1879 was said to be the main cause of the great falling off in the silk crop of that year, which was only about one-fourth of the amount ordinarily produced. The celebrated Pasteur investigated this disease, and found it to proceed from the presence of an exceedingly minute form of bacteria, so excessively small that it has been estimated that it would require eight millions of them to cover the head of an ordinary pin. When water containing these minute organisms is sprinkled on the leaves on which the silkworms are fed, they are found to be rapidly infected and capable of communicating this pestilential disease to others with which they are associated. The bacteria may be preserved in a torpid condition without loss of effectiveness for at least a year, probably for several years, and that without any particular care, and when required for use can be rapidly propagated in a suitable fluid.

In my address to you last year, I referred to a similar form of disease which had occurred among cut worms, so abundant in clover fields in the Ottawa district; and in 1878 and 1879 to a similar trouble among the forest tent caterpillars, at that time so abundant. Now, I am glad to be able to report a similar disease among the cabbage worms, and to indicate to you some practical results arising from investigations regarding its nature and mode of operation.

Throughout most of the State of Illinois and in some parts of Michigan, it was observed last autumn that a large proportion of the cabbage worms sickened and died. Hundreds of their bodies were to be seen rotting on the cabbage leaves, or shrunken and dried to a blackened fragment. This was soon brought under the notice of the State Entomologist of Illinois, Professor S. A. Forbes, a most careful and indefatigable observer, who at once proceeded to investigate the cause of this caterpillar plague. He found the disease at first to be very unevenly distributed, some isolated fields showing no trace of it, while others not far distant were fairly reeking with death and decay; but as the season advanced it spread in every direction, until in some districts almost every worm perished. He says: "We can conceive something of the significance of this disease if we imagine the terror and dread which would seize mankind if such a plague should suddenly assail human life. Whole towns would be depopulated, and the dead would rot in the streets by hundreds. There would be no escape for any, because the contagion would be conveyed by the very food and drink by which life was sustained."

On dissecting specimens of the dead caterpillars, the microscope showed their intestines to be full of undigested food, and swarming with a species of *micrococcus*, which appeared in the form of excessively minute spheres about one twenty-five thousandth of an inch in diameter, sometimes single, sometimes in pairs, and occasionally in strings of from four to eight. He found that these minute organisms could be readily cultivated in beef broth, and that a single drop of fluid from a diseased worm introduced into a vessel of such broth would in two or three days render the whole contents milky with myriads upon myriads of these microscopic organisms, precisely the same as those taken from the diseased larvæ. He also found by experiment that the disease could be communicated to other species of caterpillars. Experiments continued during the present year have shown that by propagating this form of bacteria in the manner described, and mixing a pint of a well charged culture with a barrel of water, and syringing cabbages with this fluid, the disease may be introduced, thus furnishing us with another means of defense against some of these injurious insects.

Telephonic Induction.

Mr. Preece's paper on "Induction between Wire and Wire," lately read before the British Association, revealed a somewhat alarming extent of electrical induction. In Gray's Inn Road a telegraph wire suffered induction from a telegraph cable 80 feet below in the ground. The complaints induced Mr. Preece to arrange experiments on a larger scale. In Newcastle, induction was noticeable at 3,000 feet distance. Experiments on the Durham-Darlington lines, and two other parallel lines, the one 10¼ miles east, the other 5¼ miles west, proved that on a Sunday when all other traffic was stopped, a peculiar signal given on the central wires of 18 miles length could distinctly be heard at the four corners of the two other parallel wires, and, moreover, Morse signals were heard which could only come from a line 40 miles away. Two other lines were therefore selected; one from Newcastle 55 miles long, with 10 wires, the other from Gretna, 40 miles long, with 17 wires, the two being about parallel and 40 miles distant from one another. The wail produced by intermittent increasing and decreasing currents by means of a special commutator in the one line was sadly audible in the other. Mr. Preece did not consider these tests conclusive evidence of induction, because earth was used as return lead, although the respective line terminals were most carefully insulated. Another series of experiments is, therefore, now being carried on, with gutta percha wires bent so as to form squares, of a side of ¼ mile length. Two such squares have been placed on the ground ¼ mile apart; and what is intrusted to a telephone inserted in the one closed circuit can be listened to in the other. If facts of this kind become known, the telephone will not gain in favor. Cables are not much better, perhaps; signals given in the one cable to the Scilly Islands have been heard in the other cable half a mile away. It is further intended to carry a special double line of copper wire to Wales. Professor Silvanus Thompson objected to the term induction, which has become the household explanation for a good many different troubles. As the earth was used in Mr. Preece's tests, and perfect insulation is a practical impossibility, the lines of force tapped at any two points must necessarily indicate current variations. Mr. Preece protested against having characterized the phenomena as induction phenomena. It was remarked that at the electrical tramway line at Giant's Causeway, a telegraph wire is only 28 feet from the conductor rail, and no induction effects have ever been complained of, although the postal authorities had to be satisfied about a great many points before agreeing to have the two lines so near one another. A test experiment was further suggested. Let us take three parallel wires, the one for the signals, the other two on the same side of the first for listening with the telephone at the one terminal; if we have to deal with conduction, it cannot make any difference whether or not we join the two other wires by auxiliary wires, so that they form one complete telephone circuit; if it is induction, a difference must result.

Mr. Preece further related how he had found a piece of a needle, suspected of being in his daughter's hand, when Professor Hughes' induction balance and Bell's contrivance, with which he localized the bullet in President Garfield's body, had failed. Mr. Preece strongly magnetized a steel needle of the same size as the one which had broken in his daughter's hand. Suspending this by a paper stirrup, he observed a deflection when the needle was near the hand, and succeeded in localizing the steel piece in the palm, so that an operation could be performed a fortnight after the accident, yielding a piece of the refractory needle ½ inch long.

New Theory of Coal Formation.

The *Bulletin de la Ceramique* points out that the theory enunciated by M. De Grand' Eury is opposed to the idea that large trees and shrubs produced coal; and in further support thereof it is stated that the carboniferous flora consisted of plants deficient in substances necessary for producing coal—the investigation of M. Gaston de Saporta on this point indicating that this vegetation consisted of a relatively thin circle of wood and of a large quantity of a softer substance. Brogniart and Elie de Beaumont attribute the formation of coal to the transformation of the close herbaceous vegetation which surrounded the larger forest trees and plants. Similar opinions have been expressed by M. Ponchet and other savants; so that M. Grand' Eury has more or less eminent authorities for his statement that a calculation of the accumulation of trees, etc., necessary for the conversion into even a thin coal bed of a forest suddenly buried under water, or gradually letting its residue gather on the ground, leads to an evidently erroneous result, so greatly is it necessary to exaggerate either the mass of vegetable matter or the duration of the process of coal formation. Even admitting for a moment that coal is produced by the decomposition of trees, M. Grand' Eury asks how it can be maintained that wood, in losing its moisture, has become liquid. Wood is known to contain a good deal of water, and coal has only traces of it. While he regards it as certain that coal was at one time liquid, and gradually assumed a solid shape, he considers that coal beds were formerly beds of naphtha and bituminous petroleum, produced by the decomposition of inferior aquatic vegetation under the influence of heat and dampness. As a proof of this assertion, he quotes the fact that the porous minerals found at the bottom of coal pits are impregnated in their pores with naphtha and petroleum. This is at once detected by their odor; and it is therefore argued that this naphtha could only have been absorbed during the first state of coal formation. It is further remarked that this theory serves to explain the formation of petroleum, asphalt, and other bituminous springs, which are found at various depths, and even at the bottom of some lakes. A porous soil would allow of filtration; and hence M. Fongas has remarked that in calcareous districts the coal found is usually of somewhat poor quality.

Photo Printing on Silk.

In the *Photographische Mitarbeiter* the following recipe for preparing silk for printing from is given:

No. 1.

Tannin	40 grammes.
Water	1,000 c. cm.

No. 2.

Salt	40 grammes.
Arrowroot	40 "
Acetic acid	150 c. cm.
Water	1,000 "

No. 1 is mixed with No. 2, well shaken, and filtered. The older the mixture, the better it is for use. In this bath the silk is thoroughly immersed, and allowed to remain for three minutes, when it is taken out and hung up to dry.

Sensitizing solution is composed of a silver one to ten, acidified with nitric acid.

Toning Bath.

No. 1.

Chloride of gold	1 gramme.
Water	200 c. cm.

No. 2.

Sulphocyanide of ammonium	20 grammes.
Water	500 c. cm.

No. 1, after shaking, is mixed with No. 2. In a few days the mixture will become clear, when it is ready for use. It is preferable to dilute with from two to four times the quantity of water. Fixing and washing as usual.

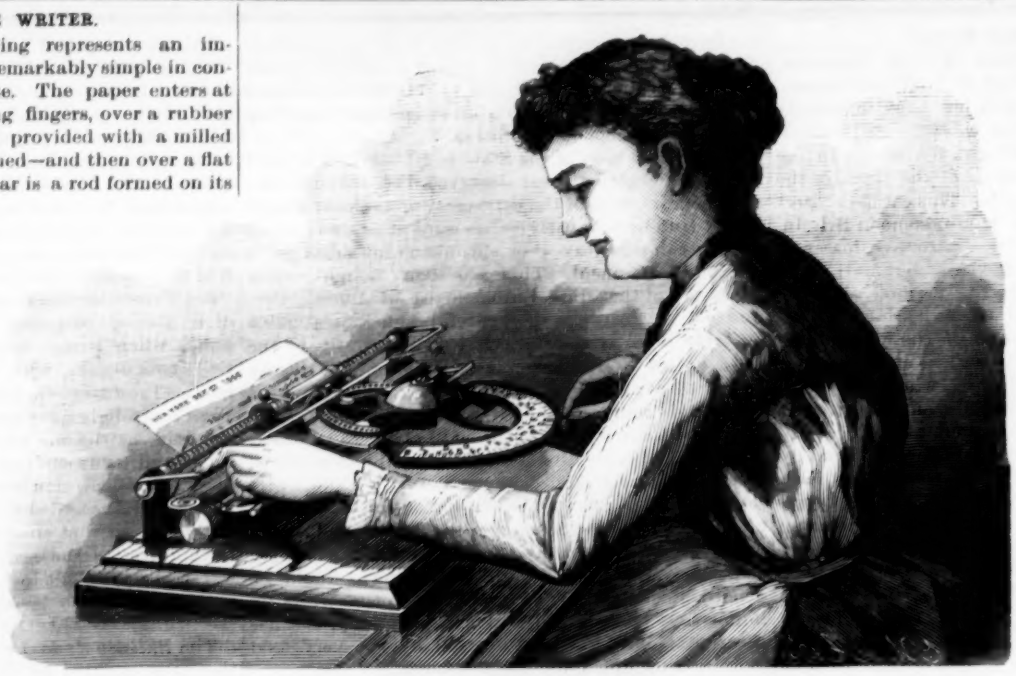
A CHEAP TYPE WRITER.

The accompanying engraving represents an improved type writer, which is remarkably simple in construction and easy to operate. The paper enters at the front, passes under spring fingers, over a rubber feed roll—one end of which is provided with a milled head, by which it may be turned—and then over a flat type bar. Just above this bar is a rod formed on its upper surface with teeth spaced to correspond with the spacing of the printed letters. Sliding upon this rod are two lugs, formed upon a thin cast plate, whose outer segmental portion is marked with the letters of the alphabet, numerals, and punctuation marks. In the center of this segment is pivoted a second one, carrying a curved rubber strip, formed with letters, etc., upon its under surface. This segment is also formed with holes, which are radially in line with the rubber letters. Pivoted to the plate is a lever, pivoted at its outer end to an arm provided with a horizontal pin adapted to enter between the teeth of the rod. The lever also carries two downwardly projecting pins, one of which, when the lever is depressed by means of a finger bar mounted upon the outer ends of the rod and extending across the machine, forces the letter under it down upon the paper, while the other, whose point is conical, enters one of the holes and serves to guide the first pin.

This simple construction prevents the rubber between the letters from being forced down, and, at the same time, renders unnecessary the accurate stopping before any particular letter of the pointer which is attached to and by which the type plate is moved. This pointer moves over the segment having the characters marked upon it, and can be rapidly shifted from letter to letter by one hand of the operator, the other hand pressing down the finger bar as each letter is indicated, this movement also shifting the type along the distance of one space. By pressing upon a thumb piece attached to the left hand end of the finger bar, the type can be moved along one space without any type making an impression. The striking of a bell notifies the operator that the end of the line has been reached. The free end of the plate is then elevated, when it can be moved back to begin another line, the paper being advanced any desired distance by turning the feed roll. Attached to the plate are two inking pads, upon which the type segment bears. The constant movement of the type over these pads insures the thorough inking of each character.

Provision is made for easily regulating the length of the printed lines. The machine has extremely few parts, not one of which is delicate or liable to get out of order.

Further particulars concerning this type writer may be obtained from World Type Writing Machine Company, 113 Prospect Street, Boston, Mass.



A CHEAP TYPE WRITER.

IN Egypt an engine specially constructed to use petroleum as fuel is drawing trains on the railway between Alexandria and Cairo.

NEW PASSENGER DEPOT OF THE ERIE RAILROAD.

The extensive passenger train shed and depot shown in the engraving are now in course of erection for the New York, Lake Erie, and Western Railroad on the Pavonia Avenue, Jersey City. The work is carried out from the designs of the company's architect, Mr. G. E. Archer, under the superintendence of Mr. C. W. Buchholz, the Chief Engineer of the department of Bridges and Buildings.

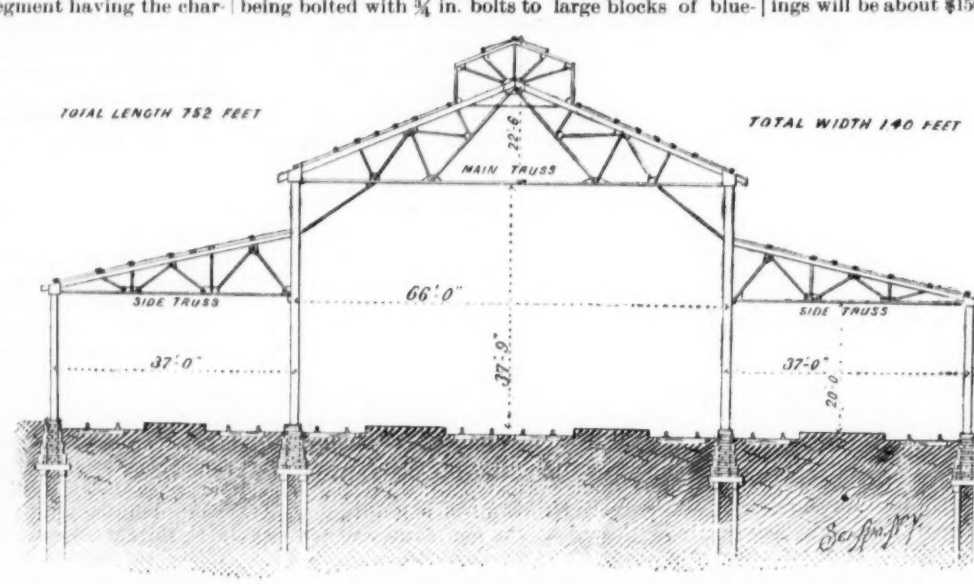
The train shed is 600 feet long and 140 wide, and is constructed in an unusually substantial manner. Iron standards or columns forming the main support of the structure are erected at distances apart of 25 ft., being bolted with ¾ in. bolts to large blocks of blue-stone built on columns of brickwork which are supported on platforms, each constructed on four wooden piles. The side of the building is covered with Cameret tin and white pine sheathing, matched and planed on both sides and double beaded. Rendle's system of glazing is used for all the extensive skylights, and the main front of the building is covered in with ornamental galvanized iron.

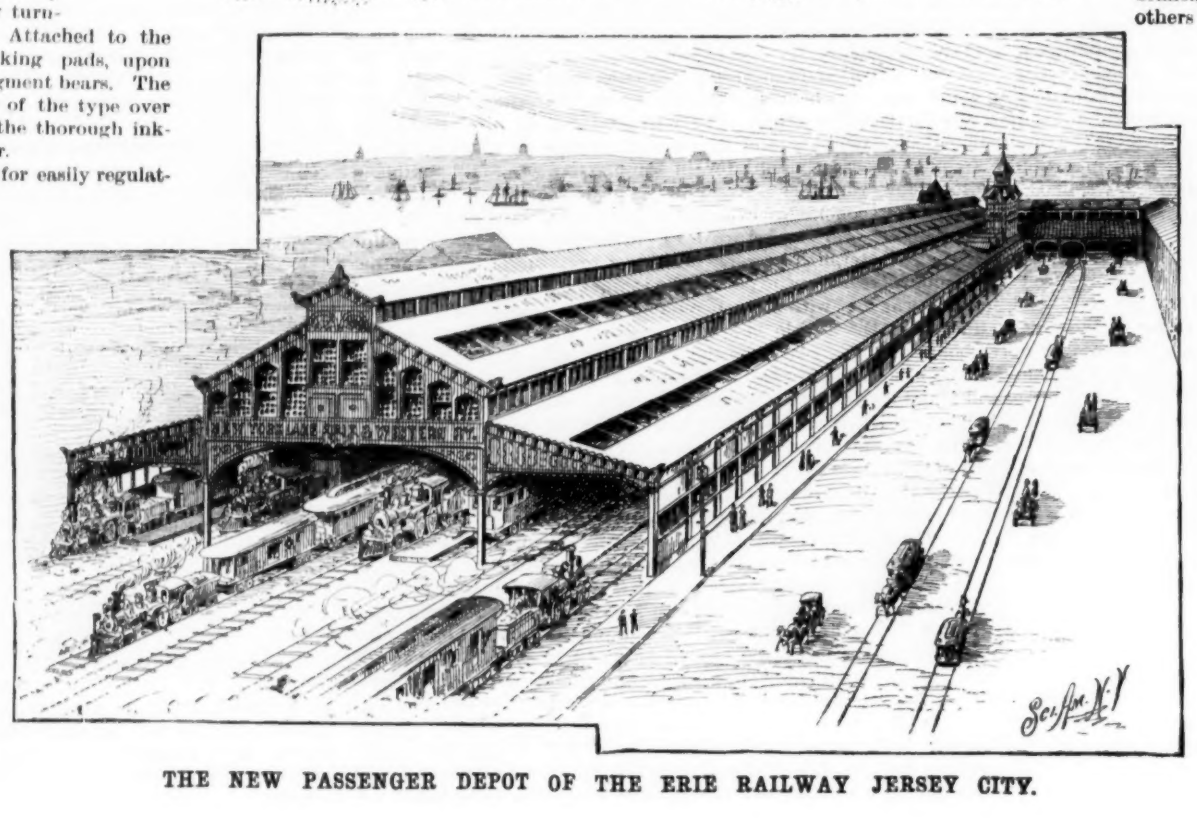
The construction of the roof is shown in our engraving of the sectional view. The main and side trusses are stiffened longitudinally with trussed purlins and latticed struts, and the roof is covered with tin laid on 1¼ in. yellow pine boards.

All the tin is painted with one coat of paint on the felt side and two coats on the outside, and the wood work is finished in three coats of olive green.

The passengers' depot, which will be shortly erected, will have a handsome elevation overlooking the river. It will be provided with two baggage rooms, office, two express rooms, restaurant and kitchen, emigrants' waiting room, and a general waiting room measuring 66 ft. × 100 ft. On the upper floor are to be the company's offices, arranged to be approached from a gallery extending around the general waiting room, which will reach the whole length of the building to the roof.

It is calculated that the total cost of the two buildings will be about $150,000, of which $75,000 will be expended on the train shed.





THE NEW PASSENGER DEPOT OF THE ERIE RAILWAY JERSEY CITY.

Cocoa Palms as Lightning Conductors.

In a recent article the *Ceylon Observer* refers to the power of the cocoa nut palm to conduct lightning. Sir Emerson Tennent long ago pointed out that this tree acts as a conductor in protecting houses from lightning, and in one instance 500 palms were struck in a single plantation during a succession of thunder storms, in April, 1859. But the trees themselves suffer terribly in the process, for however slightly they may be touched by the electric fluid, they die. Sometimes only the edges of the branches are singed, at others a few leaves turned brown alone show where the tree was touched, yet however slight the apparent effect, in course of time the tree withers gradually and dies.

In conclusion, the journal quoted inquires why it is that cocoa nut palms which have merely had their external parts, their foliage, almost imperceptibly singed, should be as much doomed to death as those which have had their vital parts permeated by the lightning, the fatal result being only protracted in the one case, while it is instantaneous in the other.

The "Noble Forehead" Fallacy.

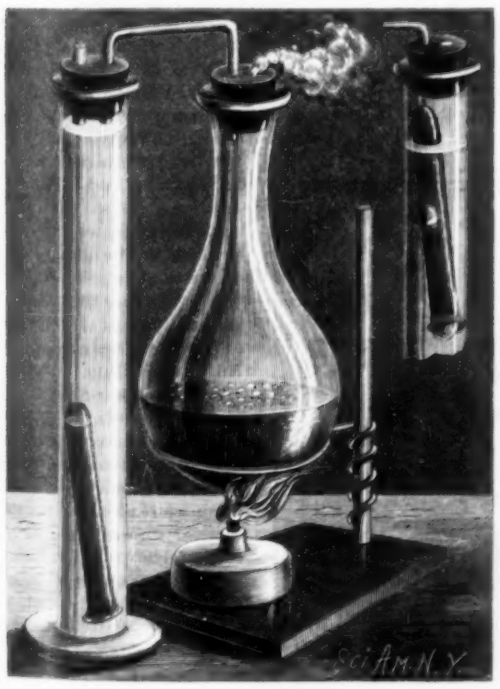
It is popularly supposed that the high forehead is essential to a good brain, and intellectual superiority is usually associated with the conception of a "two-storied brow." Dr. Wm. H. Mays ably combats this idea in the *Western Lancet*. He says:

"The size of the forehead depends much on the line of growth of the hair that limits it. A man may have what is called a low forehead; but if the hair could be removed to the height of four or five inches, the same individual would present as fine a specimen of the traditional "noble forehead" as could be wished, a perfect "dome of thought," particularly if the frontal sinuses happened to be large or protuberant. Again, a low forehead has ever been held a sign of beauty in woman, and has certainly never been regarded as an impeachment of her mental capacity. The truth is, the front part of the brain has very little to do with the intellectual process. It is the posterior lobes of the brain with which the higher faculties of the mind are associated. Gower assigns to the frontal lobes, excepting their lower and hinder portions, a negative position as regards psychical importance. Only man possesses posterior or occipital lobes; they are the latest achievements in the long line of cerebral development. In the higher apes they may be found in a very rudimentary condition; the lower mammals possess frontal or anterior lobes only. In the lower savages, and in congenital idiots, the occipital lobes are often ill developed, approaching the brute type, giving a flattened appearance to the back of the head. In the Stockton Asylum are several interesting idiots, some of whom, while possessing quite respectable foreheads, show a striking deficiency of back head. The neck and back of the head are in one line, and it is worth remarking what a foolish appearance such a contour gives an individual. When you see a lack of the rounded sweep or projection of the back of the head above the neck, you will find with it a low order of intellect. The idea that a high forehead is, taken alone, the index of mental superiority is as baseless as any of the exploded propositions of phrenology, with which pseudo-science it deserves to be classed."

EXPERIMENTS IN PNEUMATICS WITH A STEAM VACUUM.

T. O'CONOR SLOANE, PH.D.

From the two preceding articles in this series it will be seen that several experiments usually performed with an air pump can by simpler apparatus be shown almost or equally as well. It is proposed in the present paper to extend the list. After such a series as given has been followed in this work by the experimenter successfully, he will have little difficulty in going still further, and by a little ingenuity will be able to execute a full set of vacuum experiments.



CARTESIAN DIVER IN VACUO.

The existence of air in the pores of wood has already been shown. Striking as the experiment is, the air and its movements are unseen until it enters the water. It is interesting to watch the expansion and expulsion of air from a transparent vessel. A test tube is nearly filled with water and inverted in the cylinder or bottle that held the piece of wood in the former experiment. The cylinder should be almost completely filled with water. Under these conditions the inverted test tube sinks to the bottom, and rests there, with a small bubble of air in its upper end. The boiling flask is connected and a vacuum produced. As the vacuum grows greater the small residue of air in the test tube expands, the tube grows lighter, and suddenly, when enough water has been expelled by expansion of the air, ascends to the surface.

The air continues to expand, and begins to bubble out of its lower and open end. This is the action that takes place in the pores of the wood, and, just as in that case, a surprising volume of air will escape. On the readmission of air the test tube fills again, preserving a still smaller air space, and sinks at once. Each pore within the wood acts as the test tube does, and the latter experiment may be accepted as a magnified representation of the first one. As a further illustration of the expulsion of air from porous bodies, a piece of chalk may be placed in water and a vacuum produced. Air will escape from it, just as from wood.

POROSITY OF WOOD. BOILING POINT. EXPANSION OF AIR.

The porosity of wood may be illustrated by the use of the flask alone. A round stick is thrust through a short piece of rubber tubing, so as to make a tight joint in the neck of the boiling flask. The latter contains a little water, and is boiled, and while boiling the stick is introduced with its end under the water, the rubber making a tight joint between it and the neck of the flask. As the steam condenses, air will begin to steam through the stick from the outer atmosphere, and out of its lower end into the flask. After all is cool, the stick can be easily withdrawn. The ease with which it comes out shows how the vacuum has been destroyed by the air thus drawn in.

To illustrate the effect of a reduction of pressure on the boiling point, a small flask should be three-quarters filled with water, which is to be heated to a temperature a little short of boiling. All is quiescent until a vacuum is produced by connecting the boiling flask to it, and operating as described. As soon as the reduction of pressure has gone far enough, the water in the small flask begins to boil.

In many of the experiments, the close observer will notice the appearance of minute bubbles in the water in the cylinder of the experimental vessel. These must not be confounded with the steam bubbles seen in this last experiment. The minute bubbles are not steam, but are due to dissolved gas—nitrogen, carbonic acid, and probably somewhat less oxygen.

Another example of the expansion of air may be executed by the aid of the small flask. It is fitted with a tube that protrudes to a length sufficient to reach nearly to the bottom of the boiling flask when inverted over it. The small flask is thus inverted while empty, the tube passing through the cork of the boiling flask. The cork of the latter has its plug removed, otherwise all is tight. The water in the lower flask is boiled, and, after full expulsion of the air, is plugged. As the vacuum begins to be felt, the air bubbles out of the immersed end of the tube with great rapidity. When all has come that will, the plug is withdrawn. The water immediately rushes into and partially fills the upper flask. This condition is shown in the cut. A second vacuum is produced. As this is more than the preceding, more air will be withdrawn from the upper flask. By repeating this often enough, almost all the air may be expelled from the inverted flask.

The balloon already used may be borrowed, to show the elasticity of air. Most of its contents are expelled, and it is suspended from a rod or sealed tube passed through the cork of the boiling flask. It is sufficient to drop the balloon into the flask. Its attachment to the tube is a matter of convenience for its extraction. In either case its neck is tightly tied, so as to make it air tight. All being arranged, the water is boiled, the cork is plugged, and the vacuum is produced. The balloon slowly expands, and assumes a globular shape. When air is readmitted by withdrawing the plug, it suddenly collapses. When inflated, it will be much larger than the neck of the flask, and might be cited as a parallel case to the apples in the dumpling.

The last experiment illustrated is the familiar one in acoustics. The transmission of sound through space is dependent on the existence of some material substance. In the case of its transmission, waves are formed by the vibrations of the sounding body, and these waves affect the organs of hearing. Solids, liquids, and gases convey sound. A solid, to act thus, must be elastic and tense or solid.

A short piece of India rubber tubing is slipped over the end of the glass rod or sealed tube used in the last experiment. A bell, small enough to pass through the neck of the boiling flask, is attached to the end of the tube by a pin. The other opening in the cork is plugged. The water is boiled, the cork is slowly placed in the neck, and the lamp removed. As soon as cool, the bell may be rung by shaking the flask. No sound whatever will be heard if the boiling was long enough and hard enough to expel the air. The India rubber, though elastic in one sense of the word, is too loose or limp to convey sound waves.

In the future some more examples of this class of experiments may be given. By consulting text-books, more especially the older ones, hints for experiments in pneumatics may be found. An egg, by a large rubber tube, may be cushioned in the neck of the flask, a pin hole having previously been made in its inner end. Before resting it there, the water must be boiled. If the fit is good enough to hermetically close the flask, so that a vacuum is produced, and if the smaller end be placed downward, its contents will be expelled partially, at least, by the expansion of the air bubble. If a second pin hole is made in the upper end, the contents will be driven out much faster. A sharp edged metallic tube, fitted to the neck by a large rubber tube, will core an apple. While the water is boiling, an apple is screwed down on it; and if the vacuum is good enough, the core will be drawn violently down into the flask. The tube protruding from the flask must be long enough to go completely through the apple.

No difficulty will be encountered in these experiments if good rubber corks are used and rubber tube joinings between separate glass tubes are avoided.

Points on Patents.

One of the most common errors that inventors fall into is the mistaking of mere mechanical skill for invention; and one of the most puzzling things the examiner in the Patent Office and the judge on the bench are confronted with is the necessity of determining just where mechanical skill ends and invention begins.

Another error prevailing very commonly among inventors and others is that an individual or corporation has the right to manufacture a patented article, provided it is for their own use, and not made for sale. This is not so. The law gives the patentee the exclusive monopoly for seventeen years to make, use, and vend.

Another error of inventors, although not so common as those above, is that the object for which a machine is constructed, or the use to which it is to be put, is what the patent is granted for. This may be true, to a very limited extent, where the article thus produced is a new article of manufacture; but, generally, the patent is for the mechanical arrangement whereby the desired result is obtained, and not for the result itself, and the use of such patented machine for an entirely different purpose is an infringement of the patent. The granting of the patent carries with it the exclusive use of the machine, no matter for what purpose.—*C. N. Woodward, in Wood and Iron.*

BALLOON IN VACUO. ACOUSTIC PARADOX.

Waterproofing Cloths.

The following mixture is given by a correspondent in *L'Industrie Textile* as suitable for waterproofing all kinds of woven fabrics: Linseed oil, 77·0; acetate of lead, 1·845; litharge, 10·0; amber earth, 0·4; vegetable wax, 1·3; soap powder, 1·2; Manila gum, 0·7; lamp black, 4·0; essence of turpentine, 2·0; India rubber varnish, 1·555; total, 100.

A Large Anaconda.

An anaconda, 15 feet long, the largest, it is said, that ever came hither, arrived last week, and was almost immediately dispatched to the Philadelphia Zoological Garden, where it now is. Mr. Frank Thompson, the dealer in wild animals, who imported it, exhibited it to the writer in his headquarters at 411 East 56th St. An attendant knocked off the top of a large box which lay upon the floor, and the monster was seen in his entirety, the great folds of the body, of a light brown color, marked with dark circles, lying tier upon tier from the bottom to the top of the box. No sooner was the light let in upon him than he began to move his head from side to side and shoot out his forked tongue threateningly.

"I want to examine his mouth," said the dealer, "to see if there is any appearance of canker, for it is of such corroding humors that these reptiles usually die." Saying this, the dealer eyed the monster for a moment intently, and the latter returned the look with interest. Suddenly the dealer, a powerful man, thrust forward his right hand and seized the huge neck with an iron grip, and the great mouth was opened wide in anger. There was no appearance of cancerous growth, and the wary dealer, letting go his hold, dodged to one side, and the blow aimed at him by the reptile fell short. Before he could get ready for another, the top of the box was jammed down upon him. It was curious to note the effect the sight of the anaconda had upon the kangaroo and other animals in the adjoining cages. They seemed beside themselves with fright, jumping hither and thither; the eyes of the former almost starting from the sockets.

The anaconda is found almost exclusively about the Amazon watershed, and is essentially a water snake, living in or near the water. The boas come from the same locality, but are distinctly land animals. Wallace and Bates (the latter is now secretary of the Royal Geographical Society), in their voyage up the Amazon, some forty years ago, had their chicken coop, which hung over the stern of the vessel, torn to pieces and robbed by an anaconda one night while they lay at anchor, and they aver that this reptile will take any kind of an animal off a vessel's deck if he can reach it.

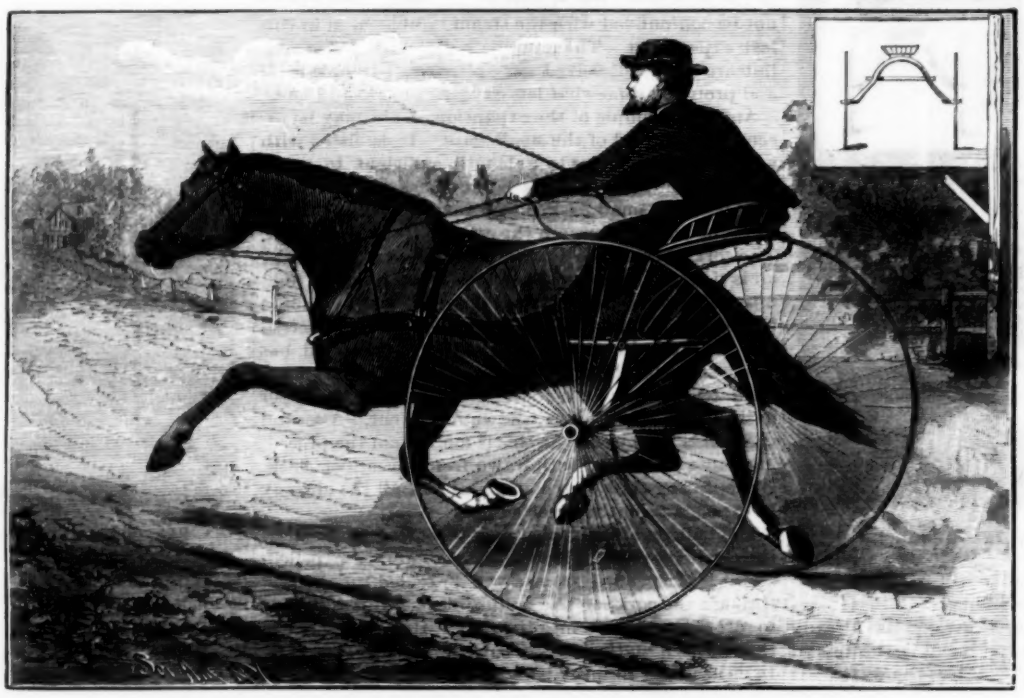
He lies hid in the water where animals are wont to come at night to drink, and when a favorable opportunity presents itself, darts his head forward, seizes his prey with his teeth, and then, dragging it into the water, he winds himself around, crushes, and then devours it.

THE "SADDLE SULKY."

The essential feature in the construction of the sulky represented in the accompanying engraving consists in so curving the axle as to admit the rear of the horse between the wheels, thus permitting the horse to turn upon his center of motion, thereby making riding in such a vehicle very safe. In many respects it is like riding in a saddle on wheels, as it is to all intents and purposes a part of the horse. The inventor claims that a vehicle of this nature will be of marked value, particularly for riding over rough roads, or where ordinary vehicles cannot be used, as there would be absolutely no danger. From the engraving it will be seen that the front of the seat of the sulky is supported upon a spring perch, rising and curving backward from the shafts, the rear portion being held upon flat springs secured to the curved bow uniting the ends of the shaft. This construction especially promotes the comfort of the rider, and avoids the unpleasant motion usually experienced in two-wheeled vehicles. The sulky is very light, and at the same time exceedingly strong, since the axles are firmly secured to the continuous shaft, and well braced.

The sulky here shown is intended for exercising horses, but we are informed that a still lighter model for trotting purposes is made, similar to the small diagram, wherein the axle makes a continuous arch under the seat over the rear of the horse. This form, the inventor claims, prevents very largely the slewing usually experienced in turning around the curves of a track, thereby tending to increase the speed of the horse and lower the record.

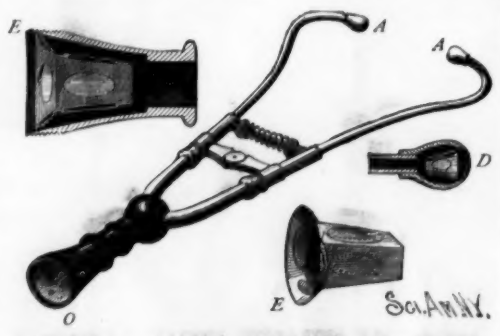
This sulky has been recently patented by Charles F. Stillman, M.D., of 142 Broadway, New York City, and is being manufactured by Brewster & Co., of Broadway and 47th Street.



STILLMAN'S "SADDLE SULKY."

IMPROVED VIBRATING STETHOSCOPE.

The engraving represents a stethoscope provided with vibrators or sound-augmenting diaphragms, arranged to act on the sounding board principle, to increase the efficiency of the instrument. The vibrators are thin disks of metal, skin, rubber, or other suitable material, placed in the ear tips and in the receiving tube. As here illustrated, the tips and receiving tube are each provided with four diaphragms held in a thimble inserted in the tips and tube in such manner as to form a sounding board chamber for each diaphragm by the relative position of the thimbles, the diaphragms, and the material of the receiving tube and the tips. Four diaphragms are preferably employed in the receiving tube, and air chambers are provided in the upper edge of each thimble.



BLODGETT'S IMPROVED VIBRATING STETHOSCOPE.

It is claimed that by this arrangement of vibrating diaphragms and air chambers the effect of the sound waves in their passage through the tubes over the diaphragms is vastly augmented, and the efficiency of the instrument to detect the most subtile and feeble sounds within the human body is increased in a remarkable degree. As shown in the engraving, the letters, E E, indicate sectional views of the vibrating diaphragms inserted in the receiving tube, O, and the letter, D, indicates sectional view of vibrating diaphragms inserted in rubber tips, A A. These diaphragms may be applied to all stethoscopes now in use.

This stethoscope is the invention of Dr. F. M. Blodgett, of No. 207 West 34th Street, New York city.

Use of Public Highway.

According to a late decision of the New York Supreme Court (McCaffrey *v.* Smith), neither the State legislature nor a village can confer authority on a person to occupy part of the public street as a hack stand as against the adjacent lot owners. The court said: The legislature undoubtedly had the power to authorize the village authorities to pass ordinances and by-laws (which they might enforce) limiting and restricting the use which the public might make of the streets beyond their rights of travel—ordinances which could be enforced as against the adjoining owners themselves for the purpose of keeping the streets open to free and uninterrupted travel. But the legislature had not the power, neither had the municipal authorities, as against the adjoining owner, to confer upon any person the right to make use of the highway for any other purpose than to pass and repass, without the consent of the owner of the fee.

Patent Rights as Property.

The *Weekly Law Bulletin* reports the following decision:

Section 14 of chapter 222, Pub. Stat., provides that execution may issue against the body of the defendant in an action of assumpsit, whenever, among other things, the defendant has been guilty of fraud "in the concealment, detention, or disposition of his property;" and an order for the execution may be granted on an *ex parte* hearing without notice to him. A judgment debtor who has a valuable patent right is not entitled to withhold it from his creditors upon the ground that it is an incorporeal or intangible right; such a right is not exempt from attachment by law, and one having property not exempt, which he detains for his own use, refusing to apply it to the payment of the judgment against him, is guilty of fraud in the detention.—*Re* Samuel D. Keene, S. C. R. I. II. New Eng. Rep., 505.

Submarine Mining Experiments.

Extensive submarine mining experiments were carried out near Portsmouth on September 14, with the view of testing the efficiency of the present system of firing mines, the system, owing to the weakness of the detonating charges, having broken down at the recent naval review. Two experiments were made. The first was with observation mines, which consisted of a line of six mines, each containing 500 lb. of gun cotton, so arranged as to blow up an enemy's ship should it have crossed the line. The mines were at the bed of the channel, covered with 10 fathoms of water, and connected by an electric tube in which was inserted at each mine a charge of fulminate of mercury. On a key being pressed, four out of six mines were exploded, and each sent up a huge volume of water, 400 feet high. Gunboats were stationed 600 yards off, and after the first violent shock the sensation was as though the boats were bumping heavily on rocks. These mines were laid on a mud bottom, large quantities of which, together with tons of fish, were blown up with the water. The next experiment was with a line of 12 countermines, supposed to be laid over an enemy's mined channel, and these also each weighed 500 lb., and were 180 feet apart. On the key being pressed, 11 out of the 12 mines exploded; but, owing to these being laid on a sandy bottom, the shock was no greater to the gunboats than in the first experiment. The tests were carried out on a point of land eight miles from Portsmouth, where the effect of the shock was not felt.

Foolhardiness.

To one who is familiar with the carelessness exhibited by persons who have served a long time in dangerous occupations or in close proximity to dangerous machines, the wonder is not that so many accidents happen, but rather that so few fatal casualties occur. A young man of exceptionally steady and cautious habits was employed some time ago by one of our leading woodworking establishments. His steady, cautious nature led to promotion, and a part of his duty required his presence where there are many rapidly revolving pulleys and belts. It was noticed that he gradually got to "fooling" with the belts, and he was warned of the danger by some of the old hands. The other day there was a sudden jar and a stoppage of a part of the machinery. An examination revealed a broken belt and the mangled corpse of the young man. The cause was evident to the coroner's jury—pure carelessness. Every week we read of accidents to carpenters, painters, etc., and no wonder. The recklessness of this class of men in trusting themselves on rickety scaffolds is incomprehensible. The other day we saw a painter at the top of a long light ladder, the foot of which rested on a frail pine goods box on a sideling pavement. On a close calculation there was not more than an inch, or at most two inches, of "center of gravity" that prevented his receiving a terrible fall. And this man, like hundreds of others, takes a pride in showing his fearlessness in the pursuit of his vocation under all circumstances. Sensible people call it foolhardiness. It has cost the life of many a good fellow, and we really believe that whenever a man exhibits unmistakable symptoms of this form of mental obliquity, he should be discharged from positions involving danger to himself or others.

A BALLOON TRIP FROM CHERBOURG TO LONDON.

A young and already celebrated aeronaut, Mr. F. Lhoste, has twice in the past made a trip through the air from Boulogne to England, but these interesting expeditions could have been successful only through his alternate utilization of superposed currents. These circumstances put it into his head to cross the English Channel, from Cherbourg as a starting point, through a S.S.W. wind, which is one that is well established and frequent in these quarters. He and his traveling companion, Mr. J. Mangot, succeeded in their very first ascent in putting into execution the bold project that they had previously announced. Among the means employed by these explorers for traveling in a balloon over the sea, we consider as very important the use of a float for converting the balloon into a captive one, and the use of a cone anchor, permitting of the reception of water hoisted up from the ocean with a pail, since the sun at daybreak tends to cause the balloon to rise into the higher regions, and to make it lose, through expansion, a portion of the gas that it contains. With these several methods of anchoring one's self to the sea and taking in ballast, it is not impossible to undertake long balloon trips over the ocean. Messrs. Lhoste and Mangot have been good enough to give us a complete account of their fine voyage, and we shall allow them to do the talking, but not before offering them all the congratulations that they merit:

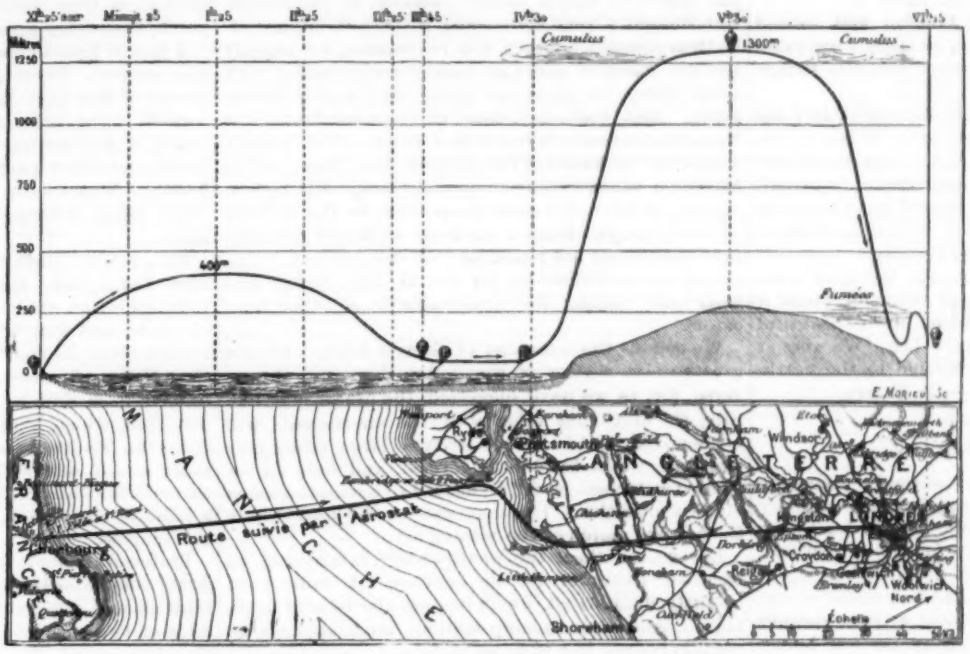


Fig. 1.—ROUTE TAKEN BY MESSRS. LHOSTE AND MANGOT IN THEIR BALLOON TRIP FROM FRANCE TO ENGLAND.

On the 29th of July, the wind being favorable, the inflation of our balloon, the Torpilleur, was begun at Cherbourg, at 6 o'clock in the evening, and was finished at 11. The arranging of the paraphernalia took half an hour. These comprised (as explained by one of us at a meeting of the Congress of Learned Societies on the 29th of April, 1886, presided over by Mr. Faye) the following: (1) A helix placed under the car, and revolved by the aeronauts; (2) a triangular sail, that started from the center and extended to a yard 15 feet in length, fastened horizontally to our ring; (3) a guide rope, 260 feet in length; (4) a cylindro-conical float, 5½ feet in length and 8½ inches in diameter; (5) a conical reservoir of a capacity of 85 gallons, and capable of serving as an anchor; (6) two pails attached to an endless rope, 525 feet in length; (7) a sheathing of cork around the car, to render the latter unsinkable; (8) ten bags, each containing 44 pounds of sand; and (9) all the necessary instruments.

At half past 11 we gave the signal for starting, and rose slowly to an altitude of 1,300 feet, which we succeeded in keeping until half past two o'clock in the morning. Scarcely had we left the roadstead when we saw that the navy was making efforts to follow our balloon by means of the Mangin electric light projector.

Despite the skill of the officers who had this important experiment in charge, we have learned with pleasure that the rays that swept the heavens never once met with us. Such want of success of men who are used to looking for torpedo boats shows how advantageous balloons would prove for approaching a given point.

The amount of ballast thrown out during the first four hours of our trip was 130 pounds, our route remaining perfectly regular. During this part of the voyage, the sky was remarkably clear around the balloon; but the horizon, on the contrary, was full of large black clouds. The brilliancy of the stars, as well as their oscillation, was very remarkable. The Milky Way gave enough light to allow of the barometer being read. We were at the end of the period of from the 26th to the 29th of July, given by the Annuaire du Bureau des Longitudes as corresponding to the occurrence of an abundant flight of meteors, with centers of emanation distributed over all parts of the celestial globe. In fact, we saw several quite brilliant shooting stars start from various points of the firmament. These sporadic meteors were white, and their mean brilliancy was that of stars of the second magnitude. We saw seven of them. The last, toward 2 o'clock in the morning, was the most brilliant of all. It left a luminous train, from which seemed to start several brilliant points, as would do the various fragments of a single sphere falling to the surface of the globe. This fire ball remained in sight for at least four seconds, and must have dropped over the ocean, so that there is little chance of its fragments having been collected. But the light was observed by a few navigators. In addition to these apparitions, we ascertained the presence of a radiant corresponding to the star Beta of the Swan, which was situated upon the limit of the zone covered by our balloon.

A large number of stars emanated from this center, and in an irregular manner. The phenomena lasted for a quarter of an hour. These stars were seen with difficulty, so that it was almost impossible to get at the number of them. Some of them shot forth at the same moment, and we saw seven or eight simultaneously.

We did not see Venus until more than an hour after she had risen. The aurora was very intense, but the brightness of the coming day worked no prejudice to the effect produced by the planet. Her aspect was truly admirable. Her brilliancy was comparable to that of an electric beacon, and much exceeded that of the Isle of Wight.

Well knowing that the appearance of daylight would give us a dangerous increase of ascensional force, we maneuvered from half past 3 o'clock in the morning to circumvent the sun's influence. For the purpose of getting to the surface of the sea, we set the helix in motion. Despite the inconvenience of operating it, the balloon was brought within 160 feet of the waves without the loss of the least amount of gas.

The float was at once let down to the surface, and as soon as it filled with water, through the orifices with which it was provided, the tension that it exerted upon its cable rendered the maneuvering easier. So we took advantage of this to set our sail.

It was then that, to our great satisfaction, we saw that we were approaching the Isle of Wight with a velocity of nine knots an hour. The resistance of the float had made us lose a notable portion of our speed, and for the purpose of making this up and obtaining a lateral direction, we trimmed our sail. The latter at once bellied, thus proving that it was acting despite its dimensions, which were small relatively to the perpendicular section of the balloon. We soon perceived that the heat of the approaching day was producing so perceptible an inflation that our float, notwithstanding its weight of 130 pounds, was skipping over the waves. Now was the moment to put in execution the last part of our plan, and to take sea water aboard as supplementary ballast. This maneuver permits of lowering the balloon at will, and bringing it within a few yards of the surface of the sea, as shown in Fig. 2.

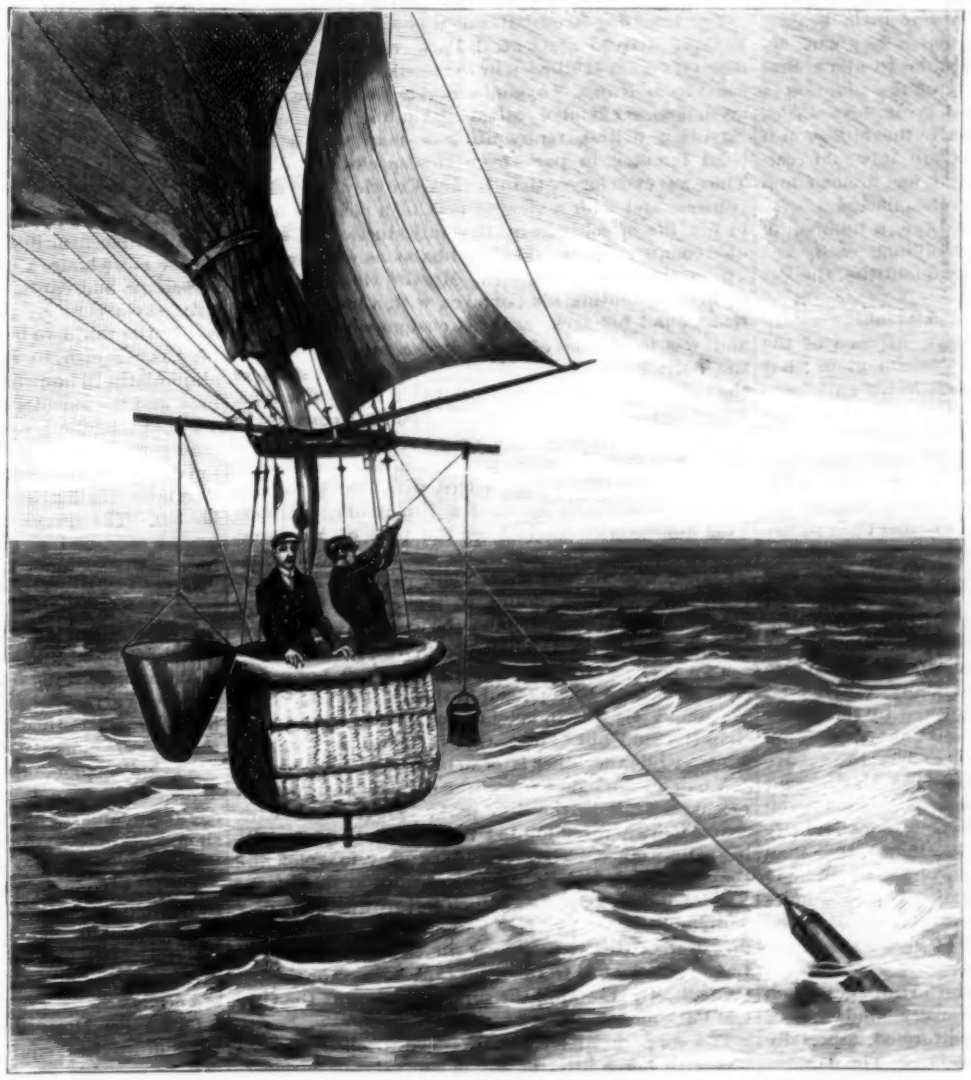


Fig. 2.—THE BALLOON TORPILLEUR, WITH ITS FLOAT TRAILING IN THE WATER.

Upon approaching the coast, our float was hauled up, after first emptying it by means of the inverting rope. Thanks to such lightening of the balloon, we rose to a height of 3,200 feet, and entered England to the west of the city of Bognor, at forty minutes past four in the morning. The limpidness and transparency of the water not far from the coast were surprising. The bottom, which was formed of rocks strewed over sand, partially covered with long seaweeds, could be seen very distinctly.

The effect of our sail had been sufficient to cause us to deviate from the course taken in the first part of the voyage; but, when given its liberty again, the balloon had resumed its first route in slightly ascending toward the north.

The sun having finally made its appearance, we rose to an altitude of 4,200 feet. As it was our intention to proceed to London, we looked attentively in the direction N.N.E. to see whether we

could distinguish either Westminster Palace or the dome of St. Paul's, which is 350 feet in height. We soon recognized the outlines of these gigantic structures. It was about 5 o'clock in the morning. Soon afterward, we saw outlined in the distance the immense course of the Thames, from its mouth as far as to beyond Windsor Castle. Keeping ourselves in the right path, we preserved our horizontality as far as to the Crystal Palace, which we left to the right.

Fearing that we might miss London and ascend toward the sources of the Thames, we opened the valve in order to bring ourselves toward London Bridge through a lower current.

This maneuver was thoroughly successful, and the great river was crossed at an altitude of 800 feet in the vicinity of the Tower. Having reascended to an altitude of 1,100 feet, we allowed ourselves to be carried along by a S.S.W. wind, which caused us to cross the city near St. Paul's, the Artillery Grounds, Victoria Park, and the entire north part of the city.

Seeing that we were leaving London, we began to descend, and, despite the violence of the wind, found it possible to stop without accident in a beautiful meadow on the banks of the river Lee. We were at Totenham Station, a charming village to the northeast of the metropolitan district.—*La Nature.*

Electric Lamps for Coal Miners.

The London *Colliery Manager* strongly urges the adoption of electric lanterns in place of the ordinary mining safety lamps. A portable electric lamp can now be made, possessing the following features: Weight, about three pounds only; illuminating power, five candles; size and shape, similar to present lamps; duration of light, ten hours; cost of repairs, charges for battery and materials, one penny for ten hours. It will be seen that in these respects there is nothing to prevent its immediate adoption, and the entire displacement of the present lamps, and even candles, in many mines where they are still in use.

A strong argument in favor of the continued use of candles in slightly gaseous mines is that they give a better light than the safety lamps, and throw a stronger light on the roof. But this argument is entirely overthrown by the electric lamp, for its illuminating power is some fifteen or twenty times as much as a Clanny lamp, and about ten times that of the ordinary miner's candle.

The small globe which contains the incandescent arc can also be placed on the top of the lamp, throwing its light all around as easily as in any other position.

The electricity in this lamp is supplied by a primary battery.

While it is satisfactory to hear that the weight is only three pounds, and therefore but little heavier than present lamps, which are generally about 2½ pounds, it would surely be a mistake to allow that consideration to stand in the way of the adoption of a lamp which offers so many and great advantages, and we should not hesitate to waive the objection if the weight were six pounds, though it would certainly be less convenient to carry for firemen and others who have much walking in the mine.

It has been said that the cost of a number of lamps would not exceed twenty shillings each, and that, if manufactured in very large quantities, the cost would be considerably less.

In respect to the consequence of breaking a lamp in gas, there is admittedly a spark exposed at the precise moment of breaking the vacuum globe; but this immediately dies out, and electricians anticipate no danger from it, in even the most explosive atmosphere.

The present lamps may receive many jars and shocks, and even be dropped to the ground, without serious injury, and frequently without putting out the light; but it is to be doubted whether their future rival, the electric, will be equally obliging, although, in this respect, much may possibly be done by constructive modifications.

The heat of the portable electric lamp is quite inconsiderable, and to hold it aslant or to splash it with water will in no way damage it. These are valuable features, and there are many others. Its light will neither affect nor be affected by the purity of the surrounding air, and it must very much increase the comfort and health of miners to remove from a large mine several hundreds of the present lamps, which, burning not only a large quantity of oil daily, but many of them also burning a large quantity of fire damp, though then giving less light rather than more, have an effect on the atmosphere which may not be noticeable with a thermometer or a chemist's appliances, but that much reduces the comfort and health of the miners, and would be gladly dispensed with by men working in hot places.

The electric lamp has also all the advantages which attach to a superior light. Nearly every kind of work may with it be more efficiently performed, especially the cleaning of the coal before loading. The dangers of hanging roofs and sides are brought into prominence, and thus great advances are made in both safety and economy.

It must be said for the present lamps that their light gives warning of the presence, in dangerous quantities, of noxious gases, and thus wards off a possibility of suffocation; and that when the existing chief security for pure air is removed, the maintenance of an adequate ventilation may be neglected, and injury to health caused thereby to the miners. But though a very convincing witness of impure air be then silenced, another will yet remain, for happily the fire damp of mines is usually accompanied by a smell which the practiced miner can readily distinguish. And, further, it must be conceded that if it is thought necessary to retain in a mine a few "safety lamps" in the hands of the firemen, the chance of an explosion emanating from a safety lamp will be lessened in at least the same proportion as the number of such lamps. But for our part, we would go to the full extent, and not retain one of the present lamps except as gas indicators for use in shot firing, and then only failing the practicability of other indicators.

We believe the adoption of electric lamps will not give rise to neglect of ventilation, but quite the reverse, for, as we have suggested, the necessity of limiting the maximum velocity of the air currents will be removed, and in the majority of large mines very large air roads have been formed, and only an increased water gauge will be needed to circulate a much larger ventilation. This may well be the next step in the onward march of the mining art.

Let us see, then, the picture which is conjured up by these thoughts for the morrow. A mine most brightly illuminated, which has not the odor of burning oil, which has no lamp stations, no lamp keys, no caution boards, but with an increased ventilation and higher air velocities, which imply no danger, but cause a purer and cooler atmosphere, and are the result of more powerful ventilating machinery without outlay on the already large airways. To complete the pleasant prospect, one thing is needed, the economical substitute for present explosives, which shall be without danger in the midst of coal dust or fire damp. The causes which lead to devastating explosions and the wholesale slaughter of the workers will then, we may hope, be altogether overcome, and each man will feel free from the incubus which now ever threatens him, and will know that his safety depends much more than formerly on his own watchfulness. The chief agencies through which a slight flaw at some point or the gross carelessness of some one man may now jeopardize hundreds of lives will then be in great measure counteracted.

NATURAL HISTORY NOTES.

Two large dog-faced baboons (*Cynocephalus anubis*, F. Cuv.) arrived at Central Park recently, and are now on public exhibition in the monkey house. They come from Nubia, Abyssinia, and are very rare. The mythological symbol called "Anubis," one of the Egyptian deities, representing a man with a dog's head, is taken in part from this species of baboon. They are even larger than Remus Crowley, the chimpanzee; and with a view of making a pleasant break in his life of solitude by the introduction of agreeable companions, the dog-faced baboons were brought up to the door of his cage. Mr. Crowley was seated at his table eating his porridge, with a napkin neatly tied around his neck, as is his custom when at meals, and was in the act of conveying a tablespoonful of the porridge to his mouth when he caught sight of the visitors from Africa, who, seated in a movable cage, were regarding him with looks of polite surprise. In an instant, he wrapped his arms around the bowl of porridge, leapt from his arm chair, and fled to the further corner of his cage, where, with the big wooden spoon held aloft, he assumed a threatening attitude. This inhospitable conduct on the part of Mr. Crowley was responded to with fierce barks by the baboons without, who showed their teeth savagely and gave other evidence of a desire to make Mr. Crowley's nearer acquaintance. Under the circumstances it was thought best to put the baboons in a separate cage.

Two very large cranes (*Grus americana*), not before seen here, have been placed in the sea lion pen. They are about 4½ feet in height, and hence larger even than the sand hill crane. One is in full plumage and white, while the other is of a beautiful light brown.

A pair of mule deer (*Cervus macrotis*) are the most recent arrivals in the deer park. Their great ears, coarse hair, and big-jointed limbs give them a striking appearance. They are dark gray in color and the tips of their tails are black, while that of the Virginian deer is white. When full grown, these deer will stand nearly five feet high at the withers. The first deer of this variety ever in Europe reached the London Zoological Gardens in 1879, being sent thither through Mr. Conklin, the superintendent of the Central Park menagerie.

The copperhead snake (*Ancistroden contortrix*) has now with her a litter of young copperheads curiously spotted and striped.

A pair of caique (*Caica melanocephala*), a species of "parrakeet," as the paroquet is now called by naturalists, was recently presented to the city, and are now to be seen in the parrot house. This is the first time they have been on public exhibition here. Their coloring is very striking; head black, throat lemon colored, back of neck orange, breast white, back and tail green. Their habitat is Demerara; and sitting, as they constantly do, close together on the perch, they keep up a constant chatter.

A pair of Upland geese (*Bernicla magellanicus*) have also arrived. These geese are found only near the Straits of Magellan and the Falkland Islands, which regions being colder than this, no trouble is anticipated in acclimating them. The male is white, with breast and under parts barred with black, while the female is brown with black bars. They breed freely while caged, differing in this respect from most wild birds.

Six pythons, each ten feet long, recently came here from India, and, though intended for the Central Park collection, could not be accepted through lack of funds, and four of them were lately sent to the Philadelphia Zoological Garden. They are of the class *Pythonidæ molurus*, the same as that supposed to have been slain by Apollo. It is the same description, too, which Virgil describes as attacking Laocoon, the Trojan priest of Apollo, who urged his comrades not to admit the wooden horse of the Greeks through the walls of Troy, which in reality contained a band of armed men, and led to the discomfiture of the Trojans.

Professor Torrey, in his "Theory of the Fine Arts," complains that the famous statue of "Laocoon," representing Laocoon and his two sons within the folds of two pythons, as pictured by Virgil, is defective because of the misconception by the artist of the instincts of the python in biting. Mr. Frank Thompson, on the other hand, who imported the pythons recently shipped to Philadelphia, and who has hunted them in Africa and India, tells the writer that Professor Torrey is in error as to this. Taking one from a box at his headquarters at 411 East 56th Street, recently, he exhibited its teeth, or rather the python did it for him. Both jaws were seen to contain a myriad of serrated teeth, and Mr. Thompson's right hand, which is now gashed about the thumb, is a striking illustration of the fact that the python can and does bite. He bites to secure his prey, and holds on until his folds are securely wrapped about it. Then he kills it by constriction. The python is not difficult to capture, and he tells the following story of his last hunt for it in Java: The Malay attendant having found a hole among the rocks where he believed a python lay hid, filled his turban with sand, which he spread out before it. The next morning, the sand showing the monster to have gone out and returned, a trap was made of bamboo and placed immediately against the mouth of the lair, and the following night a great python crept in and was easily secured.

Petroleum V. Nasby on Socialism.

I hate a capitalist, no matter how he becum one. I hate the meenspirited, grovelin retch wich will work ten or more hours a day, deprivin hisself uv beer, and terbacker, and cards, and bilyards, and hos racin, and sich, savin peny by peny til he hez ground enough out of the world to hev a shop uv his own, and to employ other men to slave fur him, and thus go on akumulatin til he owns things. Such men are monopolists, and the enemies of labor, and grinders.

I hold that the possession of a ten dolar bil makes a monopolist, and al sich shood be crushed. Ez hevin a ten dolar bil makes a man a monopolist, his monopolism increases jist in proporshen to the ten dolar bils he hez. The owner of a factory is a enemy to the human race, and ez for the man who bilds a railroad, he

> "Is a monster uv such hidgus meen,
> That to be hated needs but to be seen."

My hatred of railroad managers is intens. It commenst with the first time I wuz droped off the hind platform uv a trane for not payin fare, and hez increst with every repetishun uv the ofense, which generally happens every time I want to go anywhere. I lothe the ralerode monopolist.

A grindin monopolist is any man wich has anything. Whenever a man hez saved anything, he becomes a capitalist, and ez capitalists are dangerous to labor, he should be made to divide it up so ez to be on a ekality with them wich never saved nothing.

The mechanic or workingman wich saves so ez to own a house or a farm becomes a capitalist, and consekently a grindin monopolist, and ez accumolashens are dangerous to labor, wat he hez shud be confiskated and divided up among us wich hezn't anything. Property is a crime.

I ain't jist shoor that I hev got the socialistic doctrine down fine enuff, but I think these definishuns will do, espeshly when you howl em under a reg flag to luvers uv humanity wich is chuck full of stale beer.

ENGINEERING INVENTIONS.

A cable grip has been patented by Mr. Lewis B. White, of New York city. It is operated by compressed air, a piston from the cylinder containing which operates a rod having lateral projections, and connected with cable gripping jaws, constructed after a novel plan, that is calculated to grip and release the cable rapidly, and hold it firmly and securely.

A steam engine has been patented by Mr. Herman Knebel, of Birmingham, Ala. It is a rotary engine, with a shaft provided with a piston having a head, with steam channels opening at their inner ends, on opposite sides of the head, and extended thence outward in opposite directions, making an engine which may be revolved in either direction, and which avoids dead centers by causing the crank pin or eccentric portion to serve as a piston head.

AGRICULTURAL INVENTION.

A plow has been patented by Mr. Jonathan M. Woodley, of Clio, S. C. The invention consists in an adjustable and reversible wedge-shaped block for use with an adjustable breast part which carries the sweep or shovel, the whole forming a plow gauge adapted to suit plows of different lengths, and serving to regulate the angle or pitch and depth of entry of the sweep or shovel into the ground.

MISCELLANEOUS INVENTIONS.

An ore separator has been patented by Mr. Henry C. Krause, of Lake Linden, Mich. Its construction is such as to allow a graduated supply of water to the pan, and in such way that the valuable mineral will be separated or graded into different sizes, the machine being economical in the use of water, and being simple and not expensive.

A clothes line pulley has been patented by Messrs. John S. Collins and Edmund J. Lyons, of Brooklyn, N. Y. A forked bracket attached to a base plate carries a larger and smaller pulley, the line passing around the former and over the latter, which are so controlled by a crank that the line will be held securely and can be readily put up and taken down.

A coffin platform for graves has been patented by Mr. Seth Baker, of Colorado Springs, Col. It consists of a frame with sockets, and standards with transverse sockets, etc., whereby coffins can be readily placed over and conveniently lowered into the graves, while at the same time hiding the open mouths of the graves.

A spool holder for sewing machines has been patented by Mr. Friedrich Neuhaus, of Belleville, Ill. It is a friction device intended to prevent the spool from revolving more rapidly than is required, thus preventing the undue unwinding of the thread, it being adapted to be placed upon the spool spindle with the spool resting upon the fabric layer.

An alarm for poison receptacles has been patented by Mr. Oscar F. Frost, of Monmouth, Me. It has a clamping plate and loop supporting a bell, which is hung in such way that when the bottle or package to which it is attached is taken in hand an alarm will be rung that will give notice of the dangerous nature of the contents.

A coffee pot has been patented by Mr. Joseph M. Lawrence, of Houston, Texas. It has a false bottom and tubes extending upward therefrom and communicating with the upper parts of two chambers, with other novel features, whereby the water heated will be forced up through the tubes and discharged continuously into the receptacle containing the coffee.

A wagon bed hoist has been patented by Mr. James S. Jones, of Crutchfield, Ky. It consists of a windlass provided with a clamp, by which it may be temporarily secured to the wagon bed or bottom of the wagon box, with sheaves secured to the ceiling or upper floor joists of the carriage house, for receiving a rope in hoisting the wagon bed.

A hog pen has been patented by Mr. Lewis F. Chenoweth, of Millerton, Kan. The invention covers an improved construction in various parts and details, whereby water or fluid feed may be placed in the trough from the outside, and whereby the animals in different compartments can feed from the feed box and trough without disturbing each other.

A process of and apparatus for coating fabrics has been patented by Mr. Edward G. Sparks, of Brooklyn, N. Y. The invention provides for coating the material by projecting upon one or both sides a fine spray of the coating material, as wax, paraffine, etc., and maintaining the apparatus and material in a heated condition to insure uniform spraying over the entire surface.

A fruit evaporator has been patented by Mr. Arthur C. Penniman, of San Jose, Cal. The construction is such that the fruit trays are subjected to more intense heat at the bottom of the oven, and are then carried by wheels to a cooler upper part, to give the desired degree of evaporation, then removed through a door at the end of the revolution, where fresh trays are inserted.

A nut lock has been patented by Mr. Aaron C. Vaughan, of Shane's Crossing, O. The body portion of a nut is cut entirely through with a slit parallel to the axis of the bolt, and a portion of the part thus cut is depressed so as to act as a stout spring to bear against the other nut when screwed up, causing a strain to exist between the two nuts that prevents their turning off together.

An electric motor and generator has been patented by Mr. William Hansell, of Nevada, Iowa. They are mounted on a base common to both, and have their armatures both carried by the same shaft, with fixed pole pieces and removable electro or permanent magnets, arranged so they may be changed for others, the apparatus being intended for demonstration in schools, for medical use, and a variety of purposes.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Second-hand Tools For Sale by Poole & Hunt, Baltimore, Md.—One planing machine, will plane 25" wide, 27" high, and 16' 6" long; one planing machine, will plane 30" wide, 26" high, and 5' 6" long; one planing machine, will plane 24" wide, 22" high, and 5 feet long; one double geared chasing lathe, will swing 24" dia., 8' 6" long; one drill grinding machine; one small punching and shearing machine, with flywheel and clutch starting arrangement.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Equatorial Mountings, Reflecting Telescopes, etc. Reasonable prices. Gardam & Sons, 96 John St., N. Y.

"Of earthly goods, the best is a good wife;
A bad, the bitterest curse of earthly life."

How many wives who to-day are almost distracted because of their many ailments, all tending to make home unhappy, would become the best of all earthly goods if they got rid of their troubles by using Dr. Pierce's "Favorite Prescription," which is an unfailing remedy for those diseases and weaknesses which afflict the female sex! Send ten cents in stamps for Dr. Pierce's complete treatise on these diseases, illustrated by numerous wood cuts and colored plates. Address World's Dispensary Medical Association, Buffalo, N. Y.

Agents wanted all over the United States to sell patent spool holder for sewing machines. Sample and circular sent to any address on receipt of 20 cents. Address F. Neuhaus, Belleville, Ill. P. O. box 894

A Mussulman gentleman, resident of Lucknow, India, wants employment in America. He is a matriculated scholar of English, a professor of Persian and Arabic philosophy and religion. A poet of his own language (Urdee). For full particulars and testimonials apply to Mirza Mohamed Hadi Katra Azam Beg-Nakhas, P. O. Mansurnagar, Lucknow.

For Sale.

The powerful hydraulic dredge boat G. W. R. Bayley, now lying at Port Eads, La. Capacity, 2,000 cubic yards of sand or 4,000 of mud in 10 hours. Also two powerful tug boats. All in perfect order. Inquire at Room 709 Mutual Life Building, No. 34 Nassau St., New York.

Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

Foreman for machine tool department of a large stationary and portable engine works. Must be a draughtsman and familiar with valve movements and high speed automatic engine work; must understand handling men. To the right person there is an opportunity to secure the position of superintendent of the establishment. Address, stating age, T. E. J., P. O. box 773, New York

Eureka scroll sawing machine for sale; been run for 15 days; taken for debt; good as new. Price, $62, spot cash. Address "Eureka," Worcester, Mass.

Blake's Improved Belt Studs are the strongest and best fastening for Leather and Rubber Belts. Greene, Tweed & Co., 83 Chambers St., New York.

Engines and boilers, ½ to 4 H. P. Washburn Engine Co., Medina, O.

For Sale—The machinery, tools, plating apparatus, and raw material of a manufacturing establishment, now working on orders in brass and other metals. Very low rent, including steam power. Address Manufacturer, P. O. box 285, New Brunswick, N. J.

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Concrete Apparatus, etc. Ernest Ransome, S. F., Cal.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Machinery for Light Manufacturing on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Timber Gaining Machine. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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Safety Elevators, steam and belt power; quick and smooth. D. Frisbie & Co., 112 Liberty St., New York.

60,000 *Emerson's 1886* Book of superior saws, with Supplement, sent free to all Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa., U. S. A.

Emery, Walrus Leather, English Bull Neck and Polishers' Supplies. Greene, Tweed & Co., 83 Chambers St., New York.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 93 John St., N. Y.

Stewart's Anti-Incrustation Solution. See next issue.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

NEW BOOKS AND PUBLICATIONS.

THE AGE OF ELECTRICITY. By Park Benjamin, Ph.D. New York, 1886. Chas. Scribner's Sons. Pp. 381. Illustrated.

The general supposition with regard to a book on this subject at the present day, when so many electrical works are on the market, would be that it is not needed. Yet on perusal it at once is evident that a useful and attractive work is presented. The first chapters are devoted to the history of the subject, the honors being distributed with a very impartial hand. The day has gone by for all progress in the science to be attributed to one or two investigators. The theory of the chemical and mechanical generation of electricity is next taken up, along with the relation between electricity and magnetism. This comprises about one-fourth of the book. The economical applications are next considered, such as the electric light, motors, electrolysis, telegraphy, and telephony. A chapter on the induction coil, and another on applications of electricity to war, medicine railways etc., concludes the text. The work ends with a short index. Designed for popular use, the matter summarized above is treated in a lighter style than usual. By varied allusions to history, mythology, and literature, the book is made much more interesting than is usual in its class. The most recent curiosities and novelties are described, and hold the attention. The cuts and illustrations are numerous. Some are new, and some we recognize as very old acquaintances. The treatment of the subjects of potential and of different arrangements of battery cells, the illustrations being derived from vessels of water, and his allusion, also illustrated by cuts, to Gilbert's (of Pinafore fame) "Silver churn and the magnet," are worthy of full commendation. Some minor points are not so well disposed of. The description of Volta's pile seems far from clear. The great magnet of Professor Henry is said to have had a core 728 feet long—evidently meaning coil. We should have been pleased also to have seen the parody on Tennyson's Bugle Song attributed directly to its author, most amiable as well as most profound of philosophers, J. Clerk-Maxwell. The author's allusion to Daniel Drawbaugh, and indeed his whole treatment of the Bell telephone controversy, is characterized by a due degree of moderation, when his own part in the telephone suits is borne in mind.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) L. J. M. writes: I am using a varnish on small pocket memorandum books which require from twelve to fifteen hours to dry; when dry and packed together, they adhere, which is very objectionable. Is there anything that I can put in the varnish to make them dry quickly? A. Use 6 oz. mastic, in drops; 3 oz. coarsely powdered glass, separated from the dust by a sieve; 32 oz. spirits of wine of 40°. Place the ingredients in a sand bath over a fire, and let them boil, stirring well. When thoroughly mixed, introduce 3 oz. spirits of turpentine, boil for half an hour, remove from the fire, cool, and strain through cotton cloth. Great care in manipulation is requisite to avoid a conflagration. Use a closed fire and watch incessantly.

(2) H. B. asks: Are the sections of a Gramme electric machine's armature wound on back and forth the same as in winding wire on electro magnets? A. All sections are wound in the same direction. 2. Please give me the approximate surface speed of dynamo armatures, and does it differ in large and small machines? A. It varies from 100 feet up to several thousand feet per minute. It is greater in large machines. 3. What is the best mode to adopt in charging a Leyden jar with an induction coil? A. Attach the ball to one terminal and the outer coating to the other, and carry a wire from the outer coating to within a few inches of the ball. This distance will determine the striking distance.

(3) A. B. C. asks: Will a magnet be proportionately stronger with a given battery power if the layers of magnet wire are largely increased in number? Is a voluminous or intense current required? Is sulphide of calcium all that is necessary to make a luminous paint? A. The number of convolutions should be in proportion to the battery. Too long and fine a wire will oppose such resistance as to reduce the current. Also the outer layers will have less effect than the inner, owing to their remoteness from the core. The current should be strong, which is a function of intensity and resistance. Sulphide of calcium properly prepared is the basis of luminous paint.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

September 28, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising medium and card or ticket holder, combined, Southland & Warren 350,022
Alarm. See Fire and burglar alarm.
Algin and other useful products, E. C. C. Stanford 349,709
Amalgamator, G. S. Armstrong 349,778
Arm rest, E. A. Bennett 349,974
Automatic sprinkler, L. B. Stone 349,764
Awning, metallic, E. O. Pohl 349,810
Axle box, car, H. Still 349,767
Axle lubricator, car, Frechette & Girard (r) 10,767
Bag. See Paper bag.
Baking furnace and oven, B. B. Van Derveer 349,771
Baling press, G. Ertel 349,934
Ball. See Return ball.
Bandage, supporting, E. H. Hart 349,783
Barrel, tumbling, A. W. Getchell 349,926
Bed bottom, J. C. Peacock *et al* 350,014
Bed bottom, spring, S. J. Clark 349,980
Bed, bureau, A. Kulich 349,738
Bell switch, call, L. Townsend 349,924
Bench dog, B. B. Hoopes 349,906
Bench stop, G. B. Gardner 349,881
Blast furnaces, tuyere pipe for, F. W. Gordon 349,841
Board. See Wash board.
Boiler. See Sectional steam boiler. Steam boiler. Traction engine boiler.
Boiler cleaner, W. Row 349,955
Boiler deflector, E. S. T. Kennedy 349,739
Boot and shoe crimping machine, L. Knetzger 350,005
Boring cylinders, apparatus for, Watson & Wilcox 349,964
Bottle stopper, R. O. Stebbins 349,761
Box. See Axle box. Egg box. Journal box. Letter box. Paper box. Tool box.
Bracelet, L. Lenau 349,903
Bracket. See Shelf bracket.
Brake. See Car brake. Vehicle brake.
Brake lever, J. Kroupa 349,941
Brick kiln, L. Simpson 349,756
Brooch or badge for clubs, Phillips & Shipton 350,079
Broom, W. A. Nixon 349,897
Brush, J. G. Luddy 349,727
Burner. See Fire guard burner. Vapor burner.
Button, T. W. G. Cook 350,042
Button, M. D. Shipman 350,019, 350,020
Button fastener, A. E. Muller 350,074
Buttonhook and corkscrew, combined, Prahar & Shepard 349,741
Cable grip, L. B. White 350,028
Can. See Oil can.
Car brake, H. S. Park 349,738
Car, cable railway, L. B. White 350,031
Car coupling, G. F. Almy 349,908
Car coupling, J. C. Askren 349,679
Car coupling, M. J. Colbourne 349,696
Car coupling, W. Johnston 350,009
Car coupling, R. Jones 350,001, 350,003
Car coupling, M. H. Kern 349,848
Car coupling, D. Lippy 349,726
Car coupling, J. Locher 349,905
Car coupling, A. M. Marley 349,958
Car coupling, W. McConway 350,011
Car coupling, B. W. Sweet 349,924
Car coupling, G. F. White 349,995
Car wheel, J. J. Billingsley 349,977
Cars, pedestal and axle box for, D. McAllister 350,010
Cars, track gripping device for railway, L. B. White 350,030
Carpet sweeper, Bissell & Drew 349,694
Carpet sweeper, G. J. Cline 350,040
Carriage seat, C. Morgan 350,072
Carriage steps, pad cover for, J. T. Dickey 349,986
Cart, road, W. B. Getty 349,992
Cartridge loader, H. H. Slinn 349,818
Cash system, pneumatic, Gazaille & Low 349,708
Caster, T. F. Conklin 349,982
Caster, H. B. Plumb 349,952
Caster, trunk or furniture, S. M. Michelson 349,968
Casting compound ingots, mould for, J. Illingworth 349,886
Castrating instrument, J. Trullinger 350,048
Cellars, draining, J. Nicaise 349,735
Cereals, preparing, J. W. Robertson 349,812
Chair, G. J. Shults 349,907
Check or ticket register apparatus, J. H. Guest 349,710
Cheese knife, W. McGiven *et al* 349,732
China firing apparatus, S. S. Frackelton 349,985
Churn, D. B. Soper 349,759
Churn dasher, J. B. Mellor 349,854
Cigarette tubes, apparatus for manufacturing, A. E. Decoufle 349,785
Clamp. See Gaff clamp.
Clasp. See Garment clasp.
Cleaner. See Boiler cleaner.
Clock, D. T. Garcia 349,978
Clock, electric, D. T. Garcia 349,979
Closet. See Water closet.
Cloth, finishing imperfectly woven, N. T. Mash 350,038
Cloth, machine for winding, J. E. Windle 349,774
Cloth tentering machine, R. S. Matteson 350,069
Coffee, spice, etc., mill for grinding, Clark & Clawson 349,939
Coffins, device for locking, J. Q. A. Bennett 350,032
Collar fastener, horse, R. T. Lombard 349,963
Compasses, draughting, F. N. Gardner 349,840
Corn and cotton sweep, Lewis & Babb 349,725

Cornstalk cutter, W. R. Stafford 349,822
Corset, J. A. Anderson 349,909
Cotton gin, F. D. Child 349,892
Coupling. See Car coupling. Hose coupling. Shaft coupling. Thill coupling.
Crushing and grinding mill, J. G. Kirker 350,054
Cuff holder, Richardson & Barkelew, Jr 349,902
Cultivator, wheel, A. C. Baker 349,972
Cultivators, harrow attachment for, W. H. Hobson 349,795
Cutter. See Cornstalk cutter. Feed cutter.
Cutting holes in wood or other materials, machine for, H. Weichert 349,772
Damper, R. S. T. Cissel 349,921
Detector. See Time detector.
Digger. See Potato digger.
Dish, soap, G. H. Laxton 349,860
Display rack for parasols, etc., S. V. Hendryx 349,938
Door hanger, sliding, B. G. Wood 349,829
Door securer, J. E. Buckingham 349,988
Doubling machines, stop motion mechanism for, J. Holroyd 349,989
Drawers, W. R. Standen 349,910
Drilling machine, E. L. Mansfield 349,728
Drum, heating, J. W. Davis 349,695
Dust collector, W. Ince 350,059
Egg beater, G. H. Thomas 350,023
Egg box, E. C. Bower 349,919
Electric machine, compound wound dynamo, E. Thomson 349,912
Electric machine, dynamo, J. Jenkins 350,060
Electric machine, dynamo, R. Kennedy 350,006
Electric motor, E. T. & D. Higham 349,715
Electric motor, R. Vogler 350,025
Electric motor, dynamo, E. T. & D. Higham 349,716
Electric subway, J. M. Jacel 349,797
Electrical conductors, coupling device for, C. G. Perkins 349,989
Electrical conductors, underground conduit for, C. G. Perkins 349,739
Elevator, Frisbie & Lockwood 349,705
Elevator buckets, making, C. C. Scaife 349,754
Elevator indicator, E. Marshall 349,729
Embroidering machine, C. Guttinger 350,054
End gate lock, wagon, D. D. Whitney 349,925
Engine. See Gas engine. Gas motor engine. Motor engine. Steam engine. Steam and gas engine. Traction engine.
Engine frame jig, L. Skinner 349,757
Envelope counting machinery, A. A. Rheutan 349,745
Excelsior and material for wood pulp, manufacturing from wood, J. E. Goodwin 349,992
Extension handle, J. A. Ackley 349,917
Fan, rotary, P. Murray, Jr 349,855
Feed cutter, F. Hamachek 349,713
Fence, W. Kelly 349,940
Fence gate, wire, T. Ruediger 350,062
Fertilizer distributer, J. Hilliard 349,717
Fertilizer, rod, J. Buhrer 349,874
Fiber machine, J. Kennedy 350,063
File, bill, J. Gottschalk 349,792
Fire and burglar alarm, Thomas & Wood 349,911
Fire escape, T. B. Woodward 349,870
Fire escape ladder, J. P. Dunn 350,047
Fire guard burner and extinguisher, safety, F. W. B. Smith 350,021
Fireplace front, J. H. Sams 349,813, 349,814
Frame. See Show frame.
Furnace. See Baking furnace. Blast furnace. Hot air furnace. Steam generator furnace. Vapor burning furnace. Warm air furnace.
Gaff clamp, C. W. Brink 349,834
Gas runner and rosette fastening, combined, E. Covert 350,043
Garment clasp, D. Rosado 349,903
Gas as a fuel, utilizing natural, L. P. Rider 349,811
Gas engine, A. L. Riker 349,898
Gas motor engine, N. A. Otto 350,057
Gasoline vapor conductor, Porter & Daly 349,953
Gate. See Fence gate. Overflow gate. Sliding gate. Sliding and swinging gate.
Gate actuating mechanism, W. R. White 349,869
Governor, J. Judson 349,847
Gun, cane, F. A. Wardwell 349,864
Gunpowder press, E. Du Pont 350,048
Hame, J. Letchworth 349,891
Hame attachment, J. Letchworth 349,892
Hammer, drop, F. M. Leavitt 349,907
Handle. See Extension handle.
Harness, loop bar for, N. A. Gardiner 349,707
Harrow or cultivator tooth, F. F. Wolgamuth 349,967
Harvester binder, Harris & Lucas 349,904
Harvester, cotton, C. E. Wright 349,776
Harvester reel, F. G. Becker 349,973
Harvesters, bundle carrier for self-binding, C. F. Morgan 349,895
Harvesting and binding machine, grain, J. F. Gordon 349,842
Harvesting and binding machine, grain, W. Schwingen 349,957
Harvesting machine, R. Emerson 349,932
Hat brims, machine for folding or curling, R. Eickemeyer 349,701
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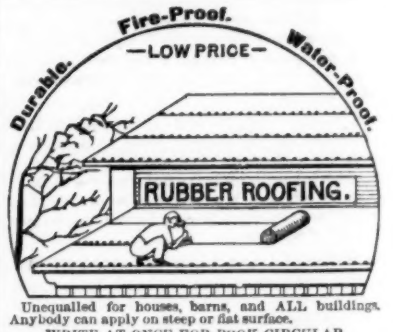

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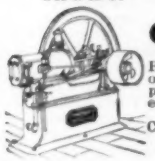

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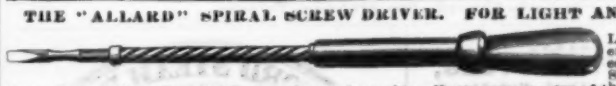

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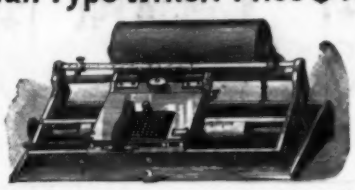

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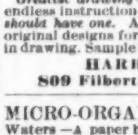

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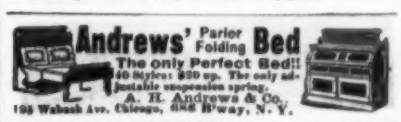

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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	3¼ tons.
8 "	5 "
10 "	9½ "
10½ "	9½ "
12 "	17½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 25 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.

There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

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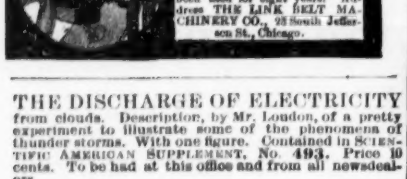
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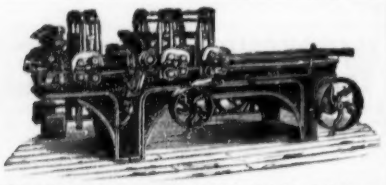

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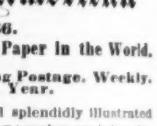

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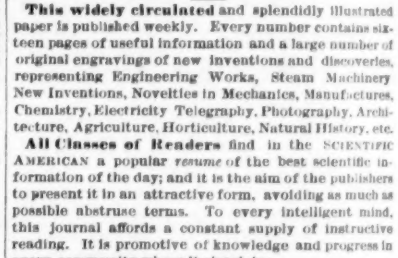

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